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Storing Coal for Strikes

For several months the consumers of large amounts of coal in the Middle West have been preparing themselves for the expected biennial April strike in the bituminous coal regions. Piles of coal along railroad rights-of-way, subaqueous coal pits of some central stations heaped to overflowing and the storage space of others filled to the fences attest the foresightedness with which many large utilities approach the periodic strife. Former experiences have shown the wisdom of preparation. The peculiar feature about the probable strike, however, is the fact that the miners are now working overtime to supply sufficient coal to tide the railroads, central stations, industrial plants and others over the period of disturbance. If a strike is declared, it will resolve itself into a test of the lasting qualities of the country's coal pile against the savings of the miner. Regardless of the outcome, a considerable saving may be effected by storing coal over what may have to be spent for fuel purchased during a strike period. If the strike, assuming that it comes at all, is of short duration, the depreciation in the heating value of the coal due to exposure will be nominal compared to what will have to be sacrificed if the utility is unprepared. Foresight is infinitely better than hindsight in such a case.

Bills for Anti-Trust Legislation

Bills designed to enact into specific law the general recommendations of President Wilson regarding anti-trust legislation have already been made public in Washington. The language of the bills and the concrete suggestions of the President are similar, and it is apparent that they are certainly an agreed part of a program made by the administration and its co-operators in Congress. The message contained many definite and hopeful reassurances to business. Necessarily the legal wording of the bills is entirely bare of any suggestion of heed for existing business practices. It is better that the President's message came first. If the bills had been made public first and the President's message had merely explained them after their introduction, the result would have been less effective. It is announced in Washington, apparently upon the best authority, that full opportunity will be offered to business men to present their ideas to the committees of Congress before action is taken. This is essential to business prosperity. It is especially needful in cases where the proposed legislation, as it now stands, threatens to disrupt or disarrange existing practices. Many of these practices have been built up in the belief that they were in conformity with law. If they were in clear conformity with the old law, but are of doubtful legality under the pending legislation, the government should not press for hasty changes at the expense of continuing trade or investment rights.

Playing to the Gallery

The controversy in progress in relation to the cost of electrical energy produced by the hydroelectric system of the Sanitary District of Chicago illustrates in a rather striking manner the unfortunate results which obtain when municipal politics is mixed with the operation of public utilities. The Sanitary District is a municipal corporation as well as the city of Chicago. The trustees of the one and the mayor and aldermen of the other are elected by direct vote of the citizens. It is difficult, apparently, for these municipal officers to consider industrial problems dispassionately and impartially. At all times the great majority of them seem to have in mind the condition of their political fences. Both the city and the Sanitary District have high-grade engineering advice. The engineers agree substantially that the price charged the city by the District for electrical energy for street lighting is too low under the existing contract. But the politicians find in the issue an excellent opportunity to pose as defenders of the rights of the people, and it is evident that many of them are doing so. The hue and cry indicates how difficult it is to conduct public service operations in a businesslike manner where the men in charge hold office for short terms and where their political future depends, or is thought to depend, on adroit appeal to popular prejudice rather than on industrial efficiency.

A Useful Consolidation

The merger of power plants in Lorain County, Ohio, of which we give an elaborate description this week, is an example of the gains which may come from wise consolidation. Enterprises of this sort are steadily growing more common as appreciation of their value is better realized. The particular instance before us combines electrically a group of towns west of Cleveland which have heretofore been served by isolated stations. Every consolidation of this kind involves special engineering problems in making the best use of the material on hand and in planning additions so as to fit the needs of growing communities. In this particular case a striking feature is the union of what now becomes the main generating station with a hydroelectric

station situated fairly in the center of the city of Elyria. This station is on the Black River and operates under a 62-ft. head. Its four generators are arranged so that they can be connected either to two waterwheels or to a pair of 350-hp gas engines which serve as auxiliary. This plant is tied in, like the others of the system, on a 22,000-volt transmission line, and when the flow is sufficient the generators are driven from the waterwheels. At other times, when heavy load comes on or when the full capacity of the station is needed, the gas engines are thrown in. At still other times, when the load is light and the capacity of this plant is not required, the alternating-current generators are thrown upon the system and operated as synchronous condensers to improve the power-factor, at the same time serving as motors to drive the direct-current machines in the same station which supply a small network not yet shifted over to the alternating-current mains. Altogether the entire system has seven generating stations and six substations. The unification of this group has resulted through energetic management in a considerable increase of business and especially in the taking on of much motor load for the large industrial works in the vicinity.

Electrolysis in Concrete

The most salient change which has occurred in the last century of building construction, since the introduction of steel, has been the use of reinforced concrete. This wonderful change in structural material which has already come about, and is even now advancing so rapidly, is due not only to the great strength, economy and convenience of reinforced cement, but also to its apparent permanence. Some concrete buildings are more costly to destroy than to erect. Iron and steel, in the firm embrace of cement, sand and stone, forget the allurements of oxygen and remain passively unrusting in the heart of a mass of moist masonry. It is not surprising, then, that engineers and builders should have heard with misgivings of electrolytic destruction of reinforced-concrete beams and blocks by stray and vagrant electric currents.

The Bureau of Standards has given special attention to this question of electrolytic disintegration in concrete and has recently published a pamphlet on the subject, which we abstract elsewhere in this issue. The results of the investigation are of great importance and interest. Briefly stated, it appears that feeble electrolytic currents in reinforced concrete have negligibly small destructive influence, so that there is no cause for alarm unless the currents are sufficiently powerful to produce sensible heating in the mass. The non-oxidizing property of steel embedded in concrete seems to cease when the temperature rises above 45 deg. C. If the current can raise the steel to this temperature and flows from steel to concrete, so that the steel is the anode, the steel is likely to be steadily oxidized. As soon as oxidization occurs the structural strength of the embedded steel begins to be affected. At the same time the iron oxide occupies more space than the original iron, so that powerful expanding forces are initiated, which may lead to the bursting of the concrete block.

According, therefore, to the conclusions reached by the bureau, we have only to make sure that there are no powerful electric currents carried by concrete in order to calm our fears as to the dangers lurking in electrolysis. Such powerful currents might, however, readily occur in buildings containing electric generating plants with heavy current leaks to ground, so that wherever conductors carrying powerful electric currents pass through concrete structures it becomes necessary to see that they do not escape from the conductors into the concrete.

Electrical Pumping for Irrigation

For some years the transmission systems in the arid portions of the West, known to the ancient geographies as the "Great American Desert," have been taking on here and there a load of motor pumping for irrigation purposes. This Great American Desert turns to a garden if properly supplied with water, and while the irrigation companies and the government have done enormous work for betterment there are sections in which natural flow is difficult to find. In these cases cheap electrical energy comes to the rescue to the benefit of all concerned. By this means water can be pumped from the rivers at a low enough cost to make it economical for irrigation purposes, and the transmission companies obtain a very welcome type of load. In the first place, when in use at all pumping is a wonderfully steady load, and, in the second place, the induction motors almost universally used for pumping are very desirable on a big transmission system with much distributed capacity. By far the biggest single enterprise of this sort is that in the Snake River Valley described in our columns this week.

The two pumping stations already installed have a combined rating of about 200,000,000 gal. for twenty-four hours when driven at full load. The lift varies from 80 ft. to 177 ft., and four canals are fed from this supply, covering an aggregate of about 18,000 acres. Centrifugal pumps are used, driven by induction motors which are fed from the 40,000-volt transmission system of the Idaho Railway, Light & Power Company. The pumps show an efficiency slightly above 80 per cent. An interesting feature of the hydraulic arrangements is that the pumps feed the canal through wood-stave conduits, portions of which operate under as great a pressure as 75 lb. per sq. in. This type of construction is used largely and very successfully throughout the West, although it has never been a favorite with Eastern engineers. Not unlikely in certain districts pumping projects of this character will be installed on a large scale, for it seems to have been demonstrated that from the standpoint of the farmer such irrigation can be

made economical, and if necessary the load could generally be so regulated as to give the transmission companies a heavy demand at periods when the load would otherwise be light. Economical operation in a hydroelectric system depends so much on the full utilization of the water that a pumping load may be desirable and worth taking on even at a very moderate price. Certainly the Snake River system should give encouragement to similar enterprises elsewhere.

The Prevention of Electrolysis

The study of methods of reducing the danger of electrolytic corrosion of pipes made by the Bureau of Standards is another evidence of the practical value of that institution to technology. Electrolysis is a condition well-nigh universal, which shows, at least here and there, unpleasant effects in the vicinity of nearly all electric-railway systems. Yet until now there has never been anything like a comprehensive study made of the methods of prevention, by reason of the fact that each place differs in its local conditions from every other place, and investigations made to remedy existing troubles necessarily have to be responsive to the local situation and cannot cover a wide scope. The Bureau of Standards, however, with the resources and skill there available, has been able to try out the fundamentals of the whole subject and consequently to present a much more comprehensive report than opportunity permits in studying the troubles of a single road.

When a grounded electric railway is paralleled by a pipe system it is perfectly certain that current will flow from one to the other and will set up electrolysis wherever it leaves either. Many attempts have been made to protect the pipes by coating them with asphalt, paint or even insulating paper, so as to prevent the access of electrical currents. Messrs. Rosa and McCollum have made an extended investigation of the reliability of such protection and, after trying out from forty to fifty kinds of paints, papers and similar protection, have found that in every single case there has been failure within a few months. Other lines of action studied by the bureau have been the use of insulating joints and "pipe drainage." These Messrs. Rosa and McCollum regard as mere palliatives, with considerable danger of local injury to the pipes in regions of high potential gradient. Methods of chemical protection appear likewise to be of dubious utility, and the researches of the bureau indicate that the real remedy should be found in preventive rather than curative measures. Investigating the economic side of the situation, however, Messrs. Rosa and McCollum find that the weak point of the uninsulated negative feeder system is irregularity of potential gradient, not to be remedied save by an excessive expenditure in copper. They find a much better condition results from an insulated negative feeder system with feeders run from the negative bus and tapped into the rail system at numerous points. By adjusting the resistance of these feeders, not only is the average potential drop in the rail greatly reduced, but it can be made remarkably uniform. Feeders of this kind have sometimes had, particularly in European practice, negative boosters connected to them. This, of course, gives the same reduction of potentials and diminution of current density in the rails, but the saving in feeder copper has to be set off against the cost of operating the boosting system.

During 1912, after these studies were well under way, the physicists of the bureau made a test on the United Railway of St. Louis with the installation of this insulated negative return feeder system. The net result of the work was to show clearly that the insulated negative feeder system gives for the same amount of copper very much less potential differences than the uninsulated feeder system as between pipes and rails, in the ratio of five or even ten to one, and in every respect is very much better adapted to the prevention of electrolysis. Of course, the particular design of such a negative feeder installation will vary greatly, according to the nature of the conditions, but from the present results it appears that it can be made without prohibitive expense to give remarkably good protection against the conditions which result in electrolysis.

The Inductance of Air-Cored Solenoids

Inductances, like taxes, are always with us. Whenever we deal with an alternating-current circuit, whatever the frequency may be, the question as to the amount of inductance present is sure to obtrude itself as soon as we commence to investigate what happens. Formulas for the inductance of air-cored coils are known, and they have been developed in recent years to a high degree of precision; but they are ordinarily complicated, from the standpoint of the engineer. The article by Mr. Leonard A. Doggett which we publish this week gives a very convenient, compact formula for determining quickly, to a moderate degree of precision, the inductance of any cylindrical coil, from a flat or pancake form to that of a long helix or tube. It depends upon three mechanical measurements of the coil —length, internal diameter and external diameter. From these, with the aid of a pair of curves, drawn on logarithm paper, the inductance of the coil can be speedily evaluated.

Although a high degree of numerical precision cannot be expected from so short a formula involving graphical estimation on a curve sheet, yet for a great many engineering purposes the degree of precision obtainable will be sufficient. Moreover, even if a measurement presents itself in which a higher degree of accuracy is required than such a formula can offer, it is ordinarily preferable to work out the inductance approximately with a short formula, and then to proceed, with further expenditure of time and effort, into refinements. Otherwise a direct calculation by means of a longer but more rigid formula may contain some arithmetical error that will render the result useless.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Society for Electrical Development

At a meeting of the directors of the Society for Electrical Development held at the society's headquarters, 29 West Thirty-ninth Street, New York City, Jan. 26, a number of important matters were thoroughly discussed by the fifteen directors present. Reports of Mr. J. M. Wakeman, general manager, and Mr. Stephen L. Coles, acting secretary-treasurer, covering the operations of the society to date were read and accepted. The society now has 1233 members, classified as follows: Manufacturers, 166; central stations, 258; jobbers and dealers, 250; contractors, 543; miscellaneous, 16. Mr. Coles, who has been the acting secretary-treasurer of the society for the past six months, was elected secretary-treasurer.

Meeting of Empire State Gas and Electric Association

The second of the midwinter meetings of the Empire State Gas and Electric Association will be held in conjunction with the Eastern New York Section of the National Electric Light Association at the Edison Club, Schenectady, Feb. 6 and 7. Dr. William McClellan will present a paper at the opening session on "Various Matters Affecting Public Opinion on Gas and Electric Companies," which will be discussed at some length by assigned speakers. Immediately after the session a buffet luncheon will be served at the Mohawk Club. A continuation of the discussion on Dr. McClellan's paper will occupy part of the afternoon session, and Mr. C. W. Stone, of the General Electric Company, will read a paper on "Commercial Aspects and New Lamp Development with a Retrospect as to the Effect of the Tungsten Lamp on Company Earnings." A dinner will be served at the Country Club in the evening, presided over by Mr. R. M. Searle, of the Rochester Railway & Light Company, past-president of the association. A trip of inspection to the General Electric Works, the American Locomotive Works and the new coal-gas plant of the Mohawk Gas Company will occupy the attention of the members on Feb. 7.

Revised Standard Specifications for Incandescent Lamps

Following increases in efficiency of tungsten lamps, the Bureau of Standards has issued the sixth edition of its Circular No. 13, containing its standard specifications for electric incandescent lamps. This supersedes the fifth edition, issued May 25, 1912. In the new edition the lamp schedules have been changed, the tungsten lamps being placed in Schedule A, the graphitized-filament lamps in B, carbon in C, and carbon series railway lamps in D. The tantalum schedule has been omitted. Life-test lamps must give 100 per cent of their specified life, except in the case of carbon lamps, which need give only 90 per cent of their specified life. This latter allowance is made because the present rating of carbon lamps in watts per candle is probably a limiting value. The efficiencies of all tungsten lamps have been raised and the limits on excepted voltages have been lowered. The tungsten schedule includes specifications for 200-260-volt lamps. In the metallized-filament schedule the 80-watt lamp has been omitted, and in both the graphitized and the tungsten schedules the sizes of bulbs for the different size lamps are designated.

Chicago Automobile Show

Practically the entire first floor of the First Regiment Armory, Chicago, which was one of the buildings used for the Chicago automobile show, Jan. 24 to 31, was occupied by the exhibits of electric pleasure-vehicle manufacturers. Storage-battery and accessory manufacturers filled the galleries of both the armory and the Coliseum. Among the "electrics" the prevailing tendency is in the direction of even more luxurious finish and lower and more graceful bodies, while the ingenuity with which the detailed difficulties of construction have been surmounted marks the electric vehicle as the car of maximum life. Although some of the makers are non-believers in new yearly models, others are presenting special 1914 designs.

On Jan. 27 the Chicago Section of the Electric Vehicle Association held a special passenger division meeting at the Lexington Hotel in connection with the show. The Electric Storage Battery Company gave a dinner at the Midday Club on the night of Jan. 28 for electric-vehicle manufacturers, dealers and others. This dinner seems to have become an annual feature of the Chicago show.

Annual Banquet of Lynn Section, A. I. E. E.

Two hundred and forty members and guests of the Lynn (Mass.) Section of the American Institute of Electrical Engineers assembled at the American House, Boston, on Jan. 24 for the annual banquet of the organization, which, with a total membership of 640, is the largest Institute section now in existence. Mr. Thomas D. Lockwood, manager of the patent department of the American Telephone & Telegraph Company, delivered the principal address of the evening on the subject "The Value of Minor Inventions." Mr. W. A. Hall, of Lynn, acted as toastmaster. The electrical decorations included miniature luminous-arc lamps carrying the Institute's name as a border along the front of the head table; a transparency of the new Lynn section button, 20 in. in diameter, and a rearrangement of the lighting of the banquet hall by the substitution of 100-watt amber-dipped lamps in the existing fixtures.

President C. O. Mailloux of the Institute was present and emphasized the spirit of solidarity illustrated by the growth of the Lynn Section, urging the full co-operation of all in making the San Francisco Electrical

Congress of 1915 a success. Mr. D. B. Rushmore voiced the need of more engineers in public life, particularly on state commissions, and Mr. W. C. Fish emphasized the importance of extending the engineering point of view throughout all walks of life. Mr. Lockwood discussed the humorous side of invention, also sketching the progress of electrical development in a philosophical vein and touching upon the relation of the telephone to the advance of civilization. Over 10,000 telephone patents have now been issued, and in 1913 there were about 25,500,000 daily telephone conversations in this country. It is estimated that the multiple switchboard saves at least ten seconds per connection, an economy of time that amounted to 928 years for American telephone users during the past twelve months.

The Electric Vehicle at Boston

At the regular meeting of the Electric Motor Car Club of Boston on Jan. 27 it was announced that in February an electric-vehicle meeting will be held at the American House, Boston, to which invitations will be sent by the Boston Edison Company to the Governor of Massachusetts, the Mayor of Boston, the Board of Street Commissioners of Boston, Massachusetts Highway Commission and other governmental authorities. Following a banquet, special efforts will be made to bring home to the public officials present the advances lately made in electric motor-car transportation. Other business includes the discussion of preliminary plans for the establishment of a down-town electric garage, giving special service during theater hours to owners of electric pleasure cars, and the consideration of organization against adverse bills before the Massachusetts Legislature bearing upon motor-vehicle service.

"Common Ground" in the Electric-Vehicle Industry

Mr. Hayden Eames, Cleveland, Ohio, speaking before the Chicago Section of the Electric Vehicle Association of America on Jan. 27, forcibly pointed out that the common ground upon which electric-vehicle manufacturers, garage owners, dealers and electric-car owners should stand is the question of public education. The average man of to-day takes no interest in an advertisement describing an electric car, said Mr. Eames, because he has not been educated to appreciate the advantages and economies derived from the use of electric vehicles. Hence work of an educational character must be done and this work will be of benefit to all concerned in the electric-vehicle industry.

Mr. Eames also stated that there was at present one electric car for each 300 inhabitants in Cleveland, Ohio. These figures give Cleveland a greater number of "electrics" per capita than any other city in the world. Although, said the speaker, a greater percentage of people in Cleveland than in any other city store and charge their cars on their own property, the garage men are prosperous. The garage man's business, maintained the speaker, should be the natural overflow from the home garages, it being a short-sighted and unwise policy for any one to discourage the tendency of an owner to keep his car at home.

In discussion near the close of the meeting Mr. H. J. Murphy, a Chicago garage owner, questioned the advisability of recent advertising of the Electric Vehicle Association, stating that the average cost of maintaining an electric vehicle in the United States was $23.50 a month. In Chicago, said Mr. Murphy, a garage owner would be unable to operate on such a price, and advertising of this type is producing dissatisfied customers.

"Tech" Research Laboratory to Study Store-Delivery Methods

R. H. Macy & Company, New York, have contributed largely to an investigation of department-store delivery methods to be carried on by the electrical research laboratory of the Massachusetts Institute of Technology, Boston, which has already made extended studies of trucking problems in that city. The Macy company employs 400 vehicles, horse-drawn, gasoline and electric, in its delivery service, the cost of which is more than $1,000,000 a year. A special staff of three research assistants will spend four or five months in New York studying the methods of the Macy store and determining the character of deliveries, zones and distances, speeds, loadings, running and standing times of wagons, etc.

The first of the present studies of the research division on the operation of delivery vehicles was undertaken at the initiation of President C. L. Edgar of the Edison Electric Illuminating Company of Boston. A paper giving the final results of this investigation will be delivered at the Electric Vehicle Association's meeting in New York Feb. 17.

Dr. Steinmetz on the Electric as the Ultimate Car

That the future of the automobile belongs to the electric vehicle was the prediction of Dr. C. P. Steinmetz in an address before the Electric Vehicle Association of America at its New York meeting, Jan. 28. Automobiling, said the speaker, is at present in very much the condition bicycling was eighteen years ago. Its attraction is chiefly that of a sport. The business or professional man drives a car because his associates have them, and despite his natural inclination in favor of some form of transportation in which the passenger is conveyed without effort. With the introduction of the cheaper gasoline automobiles the elements of "sport" and social prestige in connection with having a car are already beginning to disappear, leaving the automobile in its proper field as a utility conveyance. With the element of "sport" eliminated, the owner will no longer care to perform the labor of driving his car, and if he can afford it he will hire a chauffeur. On the other hand, the far larger class which must do its own driving will insist on having the car which is simplest and easiest to operate and maintain, and that car is, of course, the electric.

The greatest present need in the industry, declared Dr. Steinmetz, is a light, cheap electric vehicle corresponding to the Ford machine in the gasoline field. While there will always be a certain market for the present luxurious electric automobiles, a far larger opportunity exists for a plain, well-constructed, inexpensive vehicle to meet the uses of the average man. And for the broadest development of the electric vehicle the matter of charging should be handled by some central organization in each community, properly the local electric company. By off-peak early-morning charging the average passenger car could be supplied with energy at a cost as low as, say, $5 per month, or 17 cents per charge, said Dr. Steinmetz. Adding to this the cost of delivery service at, say, 10 cents per day, the expense of keeping an electric vehicle would not be

excessive. Such low rates for electric-vehicle garaging would be possible, of course, only with a comparatively large number of cars in service, but the results of such co-operation on the part of the central station would secure for it profitable use of its off-peak early-morning energy, and for the vehicle industry the greatest possible expansion in the demand for electric automobiles.

Col. E. W. M. Bailey preceded Dr. Steinmetz with an account of the recent Boston-Chicago run of a Bailey electric roadster, reports of which appeared in the *Electrical World* of Nov. 1, Nov. 8 and Dec. 6, 1913.

Electric Trucks in Post Office Service Abroad

For postal delivery service in the city of Vienna the Austrian Post Office Department now makes use of thirty 2.5-ton electric trucks which are rented on a mileage basis by a local omnibus firm. The battery equipment of each truck consists of forty-two 300-amp-hour cells, assuring a radius of travel of at least 25 miles. Each front wheel contains a 15-hp motor with couple-gear transmission. The wheel-base measures 130 in., and the front wheels are 33.5 in. in diameter and the rear wheels 35.5 in.

In Vienna, just as in the case of several American cities, the choice of electric trucks for post office service followed careful tests of an experimental fleet, the records of which were carefully investigated. The first of the present Daimler electric trucks entered the service of the Vienna post office early in 1912, and during the following twelve months this car was driven 10,600 miles. After severe tests the general postmaster, Mr. von Uhl, found the electric truck to effect a saving of about 20 per cent in operating cost, besides its manifest advantages of safety, cleanliness, simplicity, noiselessness and absence of odor.

B. J. Arnold on Subways and Terminals

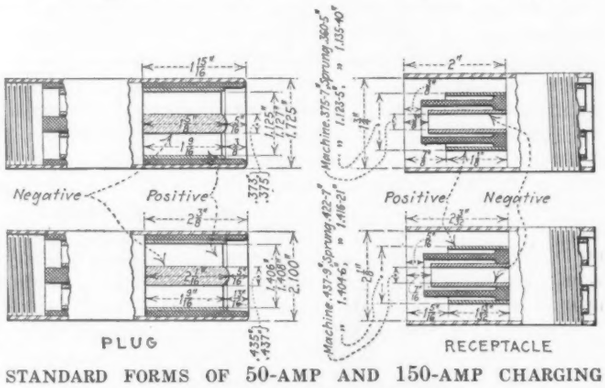
Before an exceptionally well-attended meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers on Jan. 26, Mr. Bion J. Arnold gave an illustrated talk on "Subways and Railroad Terminals." Mr. Arnold is well qualified to discuss these subjects, as he has made several engineering reports in relation to them dating back to 1902, and as he is also chairman of the Board of Supervising Engineers, Chicago Traction. Mr. R. F. Schuchardt, chairman of the electrical section of the Western Society, presided. Mr. Arnold described his 1911 plans with the aid of lantern-slide pictures and gave a lucid explanation of the general subway situation in Chicago. A vital question is the amount of rental, or interest, to be paid by the traction companies for the use of the subways. On that depends the amount of original expenditure, which probably ought not to be less than $30,000,000 or more than $50,000,000, considering the initial project. There should be no grade crossings in the subways, and this safety measure necessitates double-deck subways at intersecting points. The space between the crown of the concrete tunnels of the Chicago Tunnel Company and the street pavement is about 33 ft. To get a double-deck subway where necessary in this space has required close figuring, but Mr. Arnold feels confident that it can be done. Public-utility galleries should be provided in any system of subways adopted.

All subway schemes must, in the end, provide for a comprehensive service with high-speed, ten-car trains, each car to be as large as those used at present on the elevated railways. That does not mean that it would be wise to build more than the most needed portion first, for it seems clear that Chicago cannot support a comprehensive, city-wide subway system from the start. It is a fact, however, that a subway for surface cars can be justified only on the ground of relieving congestion. A subway for single-unit surface cars will not pay from a financial point of view. Ultimately such a subway must become part of a comprehensive high-speed system.

Mr. Arnold explained briefly the plan he has worked out for railroad terminals and his proposed system of through-routing of suburban traffic by the railroad companies. There was a brief discussion, in which Mr. James Lyman, Mr. E. N. Lake and others took part. In answer to a question Mr. Arnold said that the two-track "initial subway," recommended for Clark Street by the Board of Supervising Engineers, was not planned as a four-track subway at the beginning simply because the money was not in sight to build it. However, the subway has been planned so that it could be extended to accommodate four tracks later. Mr. Arnold expressed sympathy with the idea of defraying the cost of subways by special assessments on the property benefited. This plan has been adopted in San Francisco. The speaker mentioned the rise in the value of real estate along the line of the subways in New York north of 125th Street. This increase in values was equivalent to the cost of the subways. The special assessment plant is fundamentally just, but no doubt it would meet great opposition in Chicago.

Standard Charging Plugs for Electric Vehicles

Herewith are shown the standard forms of charging plugs and receptacles recently adopted by the Electric Vehicle Association of America. The committee which recommended these plugs comprised Messrs. E. R. Whitney, chairman; Alexander Churchward, J. R. C. Armstrong, H. H. Rice, W. E. Holland, E. J. Ross, Jr.,



STANDARD FORMS OF 50-AMP AND 150-AMP CHARGING PLUGS AND RECEPTACLES

E. Gruenfelt, Charles Blizard, J. H. Hertner and Louis Burr.

The outside contact, it will be noted, is of positive polarity while the inner contact is negative. Terminals should be marked with plus and minus signs to correspond with the polarity above given. The dimensions shown relate to plugs and receptacles for carrying 50 amp and 150 amp respectively, and the National Board of Fire Underwriters has approved plugs of these dimensions for overloads of 50 per cent beyond the current ratings given. In constructing the plugs it is desirable that the contacts be accurately concentric to insure interchangeability.

Exhibit Arrangements for Anglo-American Exposition

Celebrating the centenary of peace and progress in the arts, sciences and industries of the United States and the British Empire, the Anglo-American Exposition is to be held in London from May to October of this year. In order to interest American exhibitors special arrangements have been made for installing displays of absentee exhibitors at a fixed charge. For 100 sq. ft. of exhibit space, the booth fees for which are $2.50 per sq. ft., the committee offers, for example, to install booth and lighting, unpack and display articles, keep stands clean, furnish an attendant and supervise arrangements, all for a total charge of about $750.

The department of electricity of the exposition has been divided into the following sections: Plant, distribution of electrical energy, utilization, direct-current and alternating-current motors, heating, cooking and domestic appliances, electro-chemistry and metallurgy, telegraphy and telephony, and miscellaneous. Mr. W. H. Mordey is chairman of the electrical committee, Mr. Robert Hammond vice-chairman, and Mr. H. R. Kempe honorary secretary. The American executive offices are in the Woolworth Building, New York City, and Mr. Albert E. Kiralfy is commissioner-general.

Convention of Northwestern Cedarmen's Association

The eighteenth annual convention of the Northwestern Cedarmen's Association, held at Escanaba, Mich., Jan. 27 and 28, was well attended by the leading white-cedar producers of the Northern tier. In his opening address, Mr. M. C. Moss, president of the association, briefly reviewed the cedar industry during the last year, saying that there have been no unusual developments either in the amount of timber cut or in the number of sales. Stocks were also probably lower than in previous years. Business has been comparatively quiet, but indications now point to better conditions in both demand and price in the early future. Mr. N. E. Boucher, of Minneapolis, secretary of the association, reported that matters of reductions of freight rates have received constant attention during 1913.

The committee on changing the association's name next reported through its chairman, Mr. E. L. Clark, of the Valentine-Clark Company, who recommended that the name "The Northern White Cedar Association" be adopted by the association. This title, he said, would definitely specify the character of the cedar handled by the Northern producers as distinguished from the Western red cedar. After some good-natured opposition on the part of Mr. H. F. Partridge, this change of name was approved practically unanimously.

On Tuesday afternoon Mr. F. P. Vose, Chicago, secretary of the Electrical Credit Association of Chicago, explained the plan and scope of the latter's work. Mr. A. O. Kuehmsted, president of the credit association, also spoke. In the evening the eighteenth annual banquet was held in the large dining room of the New Delta Hotel, and at the close of the festivities the Escanaba men received a vote of thanks. A novel feature of the banquet entertainment was the impersonation by Mr. Charles Goodwin, a local cedar producer, of a French-Canadian lumberjack equipped with winter cutting kit, who forced his way into the dining room and insisted on sitting at the guests' table. After several recitations in dialect, the stranger removed his make-up and revealed his identity. Another feature was the singing of Mr. Joseph A. Naugle.

On the suggestion of Mr. E. L. Clark, a guarantee fund was subscribed to participate in the forest-products expositions at Chicago and New York, provided that the committee charged with the matter shall deem it expedient to establish an exhibit of Northern white-cedar products. The committee is composed of Messrs. E. L. Clark, L. A. Page, W. B. Thomas, J. C. Kirkpatrick, W. P. Browning and H. S. Gilke.

The following officers and directors were elected: President, Mr. J. W. Benham, Naugle Pole & Tie Company, Chicago; vice-president, Mr. L. A. Page, Jr., Page & Hill, Minneapolis, Minn.; secretary, Mr. N. E. Boucher, Minneapolis, Minn.; treasurer, Mr. W. B. Thomas; directors, Messrs. M. J. Bell, J. E. Gerich and L. A. Furlong.

Proposed Anti-Trust Legislation

Following closely the message of President Wilson to Congress in reference to anti-trust legislation, the full text of four of the bills which it is proposed to make the basis of Congressional action has been made public. The bills relate to an interstate trade commission, definitions under the Sherman law, interlocking directorates and trade relations. The fifth of the proposed bills will provide for regulation by the Interstate Commerce Commission of securities of interstate railroads.

The bill relating to the interstate trade commission provides for a commission of five members drawing a salary of $10,000 each, not more than three of whom shall be of the same political party. The Bureau of Corporations will be merged in the new commission.

All corporations engaged in interstate commerce or commerce with foreign nations, excepting common carriers, will be required to furnish information as prescribed by the commission. The commission or its agents will have complete access to all records of such corporations. Failure to comply with the act will constitute a misdemeanor and subject the corporation upon conviction to a fine of not more than $1,000 for every day of failure. The information so obtained will be a public record and may be made public by the commission. The commission will receive authority to institute an investigation to determine whether or not any corporation subject to the act was organized, or had established relations, or was conducting its business in whole or in part, in violation of the Sherman law. If the commission shall find violation, the matter will be submitted by it to the Attorney-General and proceedings will be begun. Upon request of the Attorney-General or any corporation affected, the commission shall at any time investigate any corporation subject to the act.

The section of the bill prohibiting interlocking directorates provides that after two years from date of approval of the act no person engaged as an individual, as a member of a partnership, or as a director or other officer of a corporation in the business, in whole or in part, of manufacturing or selling railroad cars or locomotives, rails, structural steel, or mining or selling coal, or in the conduct of a bank or trust company, shall act as a director or other officer or employee of any railroad or other public service corporation conducting an interstate business. After two years from date of approval of the act no person shall at the same time be a director or other officer or employee in two or more federal reserve banks, national banks or banking associations, or other banks or trust companies which are members of any reserve banks and are operating under the currency law of 1913; and a private banker and a person who is a director in any state bank or trust company not operating under the currency law shall not be

eligible to be a director in any bank or banking association or trust company operating under the currency law. Violations shall constitute a misdemeanor, punishable by a fine of $100 a day or by imprisonment for not exceeding one year, or by both.

The bill defining the Sherman law is entitled "A bill to include within the meaning of every contract, combination in the form of trust or otherwise, conspiracy in restraint of trade or commerce among the several states or with foreign nations, and within the meaning of the word 'monopolize,' certain definite offenses, and to prohibit the same." Companies, combinations or agreements for the following purposes are definitely brought within the scope of the Sherman law:

"First—To create or carry out restrictions in trade or to acquire a monopoly in any interstate trade, business or commerce.

"Second—To limit or reduce the production or increase the price of merchandise or of any commodity.

"Third—To prevent competition in manufacturing, making, transporting, selling or purchasing of merchandise, produce or any commodity.

"Fourth—To make any agreement, enter into any arrangement or arrive at any understanding by which they, directly or indirectly, undertake to prevent a free and unrestricted competition among themselves or among any purchasers or consumers in the sale, production or transportation of any product, article or commodity."

Violation shall, upon conviction, be punishable by a fine of not exceeding $5,000 or imprisonment not exceeding one year, or by both. The offense of the corporation shall be deemed to be also that of the individual directors, officers and agents of the corporation authorizing, ordering or doing any of the proscribed acts, and upon conviction they shall be deemed guilty of a misdemeanor and punished by a fine not exceeding $5,000 or imprisonment not exceeding one year, or both. Nothing contained in the act shall be taken to limit or in any way curtail the effect of the Sherman law.

The trade relations bill as drafted definitely amends the Sherman act. It shall be deemed an attempt to monopolize trade or commerce among the several states or with foreign nations or a part thereof for any person in any state or foreign country to discriminate in price between different purchasers of commodities in the same or different sections or communities with the purpose or intent thereby to injure or destroy a competitor either of such purchaser or the seller; provided that nothing contained in the bill shall prevent discrimination in price between purchasers of commodities on account of differences in the grade, quality or quantity of the commodity sold or that makes only due allowance for difference in the cost of transportation. Nothing contained in the act shall prevent persons engaged in selling goods, wares or merchandise in interstate or foreign commerce from selecting their own customers, but this provision shall not authorize the owner or operator of any mine engaged in selling its product in interstate or foreign commerce to refuse arbitrarily to sell the same to a responsible person, firm or corporation who applies to purchase. It shall be deemed an attempt to monopolize trade or commerce for any person in interstate or foreign commerce to make a sale of goods, wares or merchandise, or fix a price charged therefor, or discount from or rebate upon such price, on the condition or understanding that the purchaser thereof shall not deal in the goods, wares or merchandise of a competitor or competitors of the seller. Other provisions relate to persons who have causes for action on account of practices involving infractions of the law.

Statements of the views of President Wilson on anti-trust legislation made public on Jan. 26 amplify his message to Congress. It is his idea that the proposed interstate trade commission shall not be an administrative body but an agency for publicity and information and an adviser to the Department of Justice and the courts. The commission's findings would not be binding on anybody. The Attorney-General and not the trade commission would determine whether or not there had been infraction of the law. The courts would be privileged to amend or to refuse to accept the decrees of the commission. It is also stated that the President is anxious to have the commission avoid unfairness by giving publicity to legitimate methods of business that would help the rivals of a corporation at its expense. It is his idea, however, that there should be entire publicity by the commission in regard to matters which concern the public, particularly the investing public. The statement of the President on one point has been that the proposed legislation is not intended to bar anything that is not in nature and spirit a monopoly.

Affairs of the Sanitary District of Chicago

In his annual report for the year 1913, recently published, Mr. Thomas A. Smyth, president of the board of trustees of the Sanitary District of Chicago, makes no direct reference to the politico-industrial dispute between trustees of the Sanitary District and municipal authorities of Chicago in relation to the cost of electrical energy supplied by the District for street lighting in Chicago. Mr. Smyth says that the value of material and labor so far used in the original contract for supplying and operating 10,000 flame-arc lamps for street lighting in Chicago is $2,568,960. He advises that some method be considered by which the peak load of the District's electrical plant may be provided for, either by installing an auxiliary steam plant or by increasing the rating of the present steam plants controlled by the District. He points out that the construction of the Chicago Drainage Canal is such that there is no opportunity to store water in reservoirs, as is done in the case of other hydroelectric plants. He recommends that have arisen in relation to the operation of the electrical department. These questions are enumerated as follows:

1. Should electrical energy be sold during the day to consumers that take such energy during the peak-load period?

2. Would it be better to sell the energy during the day to those consumers only who will not take the energy during the peak-load period? In this connection it should be determined whether there is a demand for electricity under those conditions.

3. How much rating should be retained at all times as spare to take care of emergencies?

4. Would it be better to sell the electricity to consumers who take it during the peak-load period and in order to do so provide an auxiliary plant to manufacture electricity during the peak-load period?

5. What is the rate that the District can properly demand for its commercial load that will accomplish the sale of the entire day load?

Mr. Smyth recommends that the Sanitary District employ an engineer of ability to consider these subjects in collaboration with the electrical engineer of the District.

Mr. E. B. Ellicott, electrical engineer of the Sanitary District, has written a letter addressed to Mr. Thomas M. Sullivan, chairman of the engineering committee of the District, in which he says that one thing to be kept in mind by all who discuss the subject of the cost of producing the electrical energy is that the cost of pro-

duction of energy is the same for municipal and commercial purposes. The only variable is in the distribution of the energy. Mr. Ellicott says that there will be as many opinions as to the charges to be made for distributing energy as there are engineers consulted. Mr. Ellicott did not agree with Mr. Palmer, the city electrician, on all charges, but he says that he and Mr. Palmer finally adjusted their differences, and that all engineers will have to agree on the charges before an exact comparison of costs can be made. Mr. Ellicott concludes his letter by saying that unless practically all of the charges assessed against the total load by Mr. Palmer and himself are sustained, he cannot see his way clear to recommend investment of additional money to provide for the peak load caused by commercial users, "because such additional fixed charges and attendant expenses charged to commercial load might show the margin of profit so low that any considerable reduction in rates or quantity sold would show a loss on our commercial business."

Several civic organizations under the leadership of the City Club of Chicago have united in the appointment of a committee of fifty citizens to assist in making an investigation of the conduct of the electrical department of the Sanitary District. Mr. John F. Bass was elected chairman of the citizens' committee.

Annual Meeting Western Association of Electrical Inspectors

The ninth annual convention of the Western Association of Electrical Inspectors was called to order by the president, Mr. Benjamin W. Clark, of Detroit, on Jan. 27 in the convention hall of the new Hotel Gibson, Cincinnati.

Some twenty members came by special train from Chicago, where a preliminary program had been arranged at the Underwriters' Laboratories, Inc. Current break-down tests were made on tabular resistor units and voltage break-down tests on slate panels. The use of such tests in ordinary routine work of electrical fitting was explained in detail by Mr. W. H. Glover, electrical engineer of the laboratories. Further tests included demonstrations of sectional moving-picture-film cases and of the high electrical resistance along the cable of the metal sheath of armored conductors. Apparently the conductivity of such sheaths cannot be depended on to prevent burn-outs by chance leakages from contained conductors.

On the evening of Jan. 26 the delegates were entertained in Chicago at a theater party. The early registry of members at Cincinnati was unusually large, some seventy-five being present at the first session, representing municipalities and underwriters' inspection departments throughout the Central and Middle Western States, some Pacific points and Canada.

Mr. Frederick S. Spiegel, Mayor of Cincinnati, in his welcoming address briefly noted decisions made by him as a justice in the courts of his city, one of which awarded damages against a dry-goods firm for permitting wiring alterations in a display window to be made by an inexpert employee, the result being a disastrous fire and a death.

Mr. H. B. Long, of Kentucky, responding for the Western Association, spoke particularly of the growing tendency of state and municipal legislation to restrict the installation of wiring to qualified wiremen. This tendency, joined with the closer adherence to an unchanged National Electrical Code standard and wider use of the performance tests of the Underwriters' Laboratories, has been increasing the value of the inspectors' work.

Mr. Clark then made a short presidential address, in which he emphasized the necessity for concentrating attention rather on inspection methods and uniform interpretation than on uniform rules, which the National Electrical Code now so well supplies.

Mr. W. S. Boyd, secretary and treasurer, presented reports in both capacities. He stated the present membership to be 173 and spoke of the difficulty in maintaining constant progress in committee work, which has heretofore been the principal activity of this association and has resulted to an unprecedented degree in the desirable unanimity in the decisions of inspectors on inspection matters over a wide and diverse territory. Mr. Boyd suggested the advisability of collecting a reference library of electrical standards more or less supplementary to the National Electrical Code and of making such references readily available to all the members, as any individual may require such additional suggestions.

After receiving invitations from several cities, among them Minneapolis, St. Boniface (Manitoba), San Francisco and Indianapolis for next year's meeting and the reference of these invitations to the executive, the president appointed a nominating committee, a committee to report on the circulating or reference library matter, and a committee to revise the articles of association with a view to extending the territory from which active members may be admitted. The inclusion of Canadian and Pacific Coast members has been particularly urged by the representatives from many municipalities in those sections.

Overhead Wiring

The report of the committee on overhead wiring was next presented by Mr. Guy W. See, acting chairman. Mr. See referred only to the questions of insulation of wires and insulating guy wires. The committee recommended use of insulation for circuits up to nominal 2300 volts operating potential, both from the standpoint of continuity of service and from that of additional safeguard to linemen working among such wires. The recommendations of the National Electric Light Association's overhead-wiring committee were adopted in substance by the Western Association committee as its own for guy-wire insulation and grounding.

Somewhat in confirmation of the suggestions of the above committee were the conclusions stated by Mr. E. J. McGann in his paper on "Whether 2300-Volt Primaries Should Be Run Without Insulation on the Conductor Itself." Mr. McGann has conducted at the electrical laboratories of the city of Chicago a number of tests on various samples of weatherproof wire to determine the effectiveness of the insulation as a dielectric after different periods of use. These tests were made on dry and immersed samples, new and in service for three, five and ten years. While new wire with moisture repellant still in place withstood four times the normal voltage of the lines, wet samples barely withstood the line voltage to ground, but showed a good factor of safety for line crosses where the insulation of two wires is interposed. Samples taken out of lines which had been in service several years had lost very considerably in dielectric strength dry, but even more wet, and none but the new wire gave an insulation test indicating reliable protection for linemen on poles. The tests show that in general even wet insulation may for 2300 volts be depended on for ten years if the insulation remains intact to prevent break-down when wires of opposite polarity swing together. Mr. McGann drew the conclusions that present standards of weatherproof insulation give a distinct advantage over uninsulated wire by protecting against primary contacts to secondary, protecting continuity of service

and protecting linemen in dry weather or with new insulation. Mr. McGann concluded with an earnest plea for a better insulation for overhead wires, asserting that dearer line construction would be repaid by greater safety to life and apparatus and by continuity of service, and suggested that the overhead-wiring committee bring in at the next meeting specifications for such an insulation.

While not intended as at all exhaustive, this series of tests marks a real advance in the present knowledge of the value of weatherproof insulation for 2300-volt construction. The question of 6600-volt construction was not touched on, and at least for present insulation Mr. McGann recommended use of insulating gloves by linemen working on live 2300-volt lines.

Show-Window Lighting

The report of the committee on show-window and display lighting was read by the secretary of the association in the absence of the chairman, Mr. F. P. McGough.

The report gave a summary of progress in show-window lighting and the part inspection has played in securing efficient as well as safe window illumination. Some recommendations were included as to means of avoiding certain hazards incident to the use of lamps near the displayed materials, and particular mention was made of the disadvantages of stem fixtures from their frailty and liability to grounds. Key sockets were condemned and lamps exposed to contact on side walls were shown to be ineffective as well as readily injured.

Temporary wiring and the use of low-hanging display fixtures were generally censured, and the analogy between good illumination and safe, permanent construction was clearly drawn.

Discussion was left to a later session, in the belief that it would be more valuable if it were all covered under the head of "Inspection Problems."

On the evening of Jan. 27 the members were entertained at a "smoker" given by the Cincinnati electrical interests.

Incandescent Lamps

Wednesday's session opened with a paper by Mr. R. H. Shenton, of the National Electric Lamp Works, who spoke on "The Incandescent Lamp and Its Circuit." The speaker remarked that just as the efficiency of light sources has increased, so has the demand for illumination, and while the incandescent lamp has now one-fourteenth the power consumption per candle that was demanded by its predecessors twenty years ago, the power consumption for illuminating a given area has risen. There is, however, a subdivision into smaller units, and Mr. Shenton questioned the necessity for so close a limitation of the number of lamps per circuit as the sixteen prescribed by the National Electric Code.

The discussion brought out the possible fire hazard caused by reason of the comparatively high bulb temperature of the gas-filled incandescent lamps of to-day, which the speaker explained was a result of convection taking the place, to some extent, of the radiation of heat from the incandescent filament.

Car Wiring

The report of Mr. F. Daniel for the committee on electric traction systems dealt solely with car wiring, and the committee proposed a complete set of rules for car wiring to cover the higher voltage systems as well as the 550-volt systems at present contemplated by the National Electrical Code rules. The proposed changes from the present requirements for car wiring at lower potentials consist of modifications which have been indicated by actual experience with car wiring installed in accordance with present rules. An interesting talk on car-wiring progress was given by Mr. M. C. Anderson, of the Cincinnati Car Works, at the afternoon session.

Theater Wiring

Mr. F. L. Lucas, chairman of the committee on theater wiring, reported in favor of requiring all permanent theater motors to be of the inclosed type, unless placed in fireproof rooms. He also urged a record by inspection departments of the defects noted in incoming show equipments as a safeguide to inherent defects of various types of devices and the sending of notices as to local inspection department requirements of the National Electrical Code. Standard construction was also recommended to each theatrical company booked a short time before the date of its arrival. The afternoon session was concluded with a discussion of various inspection problems, some of which will be touched upon in a later issue.

On Wednesday night a banquet provided by the electrical salesmen and contractors of Cincinnati was held in the ballroom of the Hotel Gibson. The growth in co-operation between the formerly antagonistic constructive electrical interests and inspection departments in Cincinnati was made the subject of much comment. Some of the early inspection problems were recalled with mutual interest to manufacturers, contractors and inspectors. Mr. W. E. Milnor, of Cincinnati, acted as toastmaster, and all but one of the past-presidents of the association were present and made addresses, a telegram being sent by Mr. Waldemar Michaelson, of Omaha.

The program for Thursday morning consisted of committee reports as follows: "Installation and Operation of Induction Motors," by Mr. K. W. Adkins; "Architects' Specifications," by Mr. F. H. Moore; "Signal Systems," by Mr. F. S. Anderson; "Rubber-Covered Wire," by Mr. B. H. Tousley. In the afternoon there was a tour of inspection which included the pumping station and filtration plants of the new Cincinnati water-works.

Public Service Commission News

Wisconsin Commission

A letter and data sheets have been sent out by the statistical department of the Railroad Commission of Wisconsin to the electric utilities of the State. It is the commission's plan to use the information received in the replies to formulate a set of rules or recommendations for the guidance of utilities seeking advice on the question of extensions or other allied matters.

A committee was appointed at the recent convention of the Wisconsin Electrical Association to make a similar investigation. It is probable that this committee will work in conjunction with the commission, with the result that the commission may issue a formal order in the matter or that the essence of the report may be incorporated in the rules for electric service.

The questions which the commission asked the utilities to answer are as follows:

"1. Have you a definite practice regarding the treatment of the expense of extending your lines to reach applicants for electric service?

"2. Is the expense of such extensions represented by a fixed amount per prospective consumer, or does it vary with the estimated revenue to be received from the applicant or group of applicants? State rule in full.

"3. (a) What is your rule in regard to extending lines beyond the point to which they will be extended without charge by the utility; that is, will you extend lines beyond the usual distance if the prospective con-

sumer or consumers agree to meet a portion of the cost? (b) When consumers share in the cost of extensions, is the money advanced by them refunded? If so, under what conditions?

"4. Do you make a charge for connecting consumers where it is unnecessary to extend the lines? If so, what is the amount and basis of this charge?"

New Jersey Commission

The Board of Public Utility Commissioners has granted the Commonwealth Water & Light Company, of Summit, N. J., permission to issue $150,000 of 6 per cent five-year notes, subject to the specific understanding that it proceed at once to separate its properties into distinct corporations. With such provisions the water properties controlled by the company in the northern section of the State will be consolidated into one company, and the electric companies into a single electric company. In the Lakewood section the water and sewer properties will be brought under the control of the Lakewood Water Company, and all electric properties in both Lakewood and Point Pleasant sections will be under the jurisdiction of the Lakewood Electric Company.

The Jersey Power Company, of Boonton, has made application to the board for permission to issue $75,000 securities, the proceeds to be used for extensions.

Current News Notes

OHIO STATE UNIVERSITY ELECTRICAL SHOW.—Members of the student branch of the American Institute of Electrical Engineers at Ohio State University, Columbus, Ohio, will hold an electrical show April 16, 17 and 18, similar to the one given several years ago. It is planned to have exhibits from several hundred manufacturers of all kinds of electrical machinery and apparatus.

* * *

RADIO STATIONS.—Supplement No. 1 to the list of radio stations of the United States, edition of July 1, 1913, has been issued by the Department of Commerce, covering all additions and alterations to Oct. 1, 1913. The new supplement contains twenty-seven pages and can be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents per copy.

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AN OBLIGING STREET-LIGHTING SCHEDULE.—From the Rolling Prairie (Ind.) *Record* is quoted the following self-explanatory notice: "Hereafter the street lamps will be turned off at 10 o'clock at night. If there is any person expected to return home by late train or any public gathering, the lights will be left burning until a later hour if such notice is given central at the telephone office."

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CLEVELAND TO HAVE AN ELECTRIC SHOW IN MAY.—The Electrical League of Cleveland is planning a large electrical exhibition to be held in that city in May. A committee consisting of Messrs. M. E. Turner, of the Cleveland Electric Illuminating Company; N. H. Boynton, of the National Electric Lamp Association, and T. P. Cagwin, of the Cleveland Telephone Company, has reported favorably. Many electrical concerns have signified their intention to take space.

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EXTENSION OF NORTHWEST STATION.—Work on the extension of the Northwest generating station of the Commonwealth Edison Company of Chicago was begun last month. This station has two vertical 20,000-kw generating units, while a horizontal 30,000-kw unit, for which the present extension will provide, is on order. At the same time the addition to the Fisk Street station, housing the 25,000-kw and 20,000-kw units now under erection, is well advanced toward completion.

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ELECTRIC SHOW FOR SALT LAKE CITY.—The Electric Show Association of Utah will hold its third annual exhibit at Salt Lake City during the first week of April. A large downtown building has been arranged for the occasion and the show promises to be one of the most successful ever given by the association. The officers for 1914 have been elected as follows: Mr. B. W. Mendenhall, president; Mr. C. B. Hawley, vice-president; Mr. W. W. Torrence, secretary, and Mr. J. C. Gleeson, treasurer.

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NAVIGABILITY OF DESPLAINES RIVER.—In the pending suit before the United States Supreme Court Attorney-General P. J. Lucey of the State of Illinois has filed a brief contending that the Desplaines River is a navigable stream. His object is to defeat the attempt of the Economy Light & Power Company, of Joliet (now a part of the Public Service Company of Northern Illinois), to construct a dam across the Desplaines River at Dresden Heights. The company has contended that the river is not navigable.

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STREET-LIGHTING SURVEY FOR MILWAUKEE.—A thorough survey of Milwaukee's street-lighting equipment will be made under supervision of the Common Council, according to the newspapers of that city. The finance committee of the Council has recommended an appropriation of $5,000 for the purpose. The present street-lighting system is said to be inefficient and wasteful, owing to the practice of allowing aldermen to cause lamps to be placed indiscriminately to please individuals rather than to serve the needs of the community.

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HYDRAULIC WORK ON COON RAPIDS PLANT COMPLETED.—The hydraulic work on the Coon Rapids hydroelectric plant of H. M. Byllesby & Company on the Mississippi River, about 11 miles north of Minneapolis, is practically completed. Work will be begun at once on the generating station, and it is expected that before the end of the present year electrical energy will be transmitted to Minneapolis, where it will be used by the Minneapolis General Electric Company. The ultimate rating of the plant will be about 15,000 hp. An article in the *Electrical World* of Nov. 29, 1913, page 1094, gave an outline description of the enterprise.

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BUFFALO ELECTRIC SHOW.—Under the auspices of the Jovian League of Buffalo, N. Y., an electric show is to be held at the Elmwood Music Hall in that city March 9 to 14. An electric fountain will be the central feature of the 10,000-ft. exhibit space, the illumination effects for which have been designed by Mr. W. D'A. Ryan. Mr. E. D. McCarthy is general chairman of the Buffalo Electric Show, Mr. W. E. Robertson is in charge of exhibits, Mr. W. R. Huntley of finance, Mr. G. H. Calkins of concessions, Mr. L. F. Philo of advertising and publicity, Mr. H. I. Sackett of the program, Mr. J. J. O'Leary of decorations and illumination, Mr. F. A. Coupal of service, Mr. C. W. Underwood of entertainment, and Mr. L. W. Wipperman of tickets and admissions. Mr. Harry S. Hilliker is secretary of the show,, the general offices of which are in the Electric Building, Buffalo.

SUGGESTS LEGISLATION TO EQUALIZE LIGHTING COST.—In a recent talk before the Cook County Real Estate Board, Mr. W. D. Wilcox, chief inspector of gas meters in Chicago, outlined a plan for providing a more equitable distribution of cost for supplemental lighting of business streets. Existing laws provide for the construction of paving and sidewalks by special assessment, but no similar legislation allows street lighting to be installed on that plan. Some of the improvement clubs and business associations in the city of Chicago are planning to take the question before the next meeting of the Legislature at Springfield, aiming to make all pay an equal share for lighting from which they benefit.

* * *

NATIONAL EFFICIENCY EXPOSITION.—The first National Efficiency Exposition and Conference will be held at the Grand Central Palace, New York City, April 4 to 11, inclusive, under the auspices of the Efficiency Society. The plan and scope of the show will include displays of efficiency appliances, methods and products in the industrial, mechanical, governmental, educational and household fields. Mr. William R. Willcox, ex-chairman of the New York Public Service Commission, will preside over the exposition, which numbers among its advisory committee Messrs. F. H. Bethel, vice-president New York Telephone Company; Arthur Williams, general inspector New York Edison Company, and T. S. Williams, president Brooklyn Rapid Transit Company.

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"REFRESHING" THE PARTS OF A HORSE-POWER.—A machine which, although not "perpetual motion," will run indefinitely, stopping "only when parts are worn out," is described by the Cleveland (Ohio) *Press* as being made ready for the market by Mr. August C. Rutzen, of Cleveland. "The secret of our machine is that while ninety-nine parts of a horse-power are working, the other one is being refreshed," the promoter is quoted as explaining. "It is a scheme mathematicians have overlooked. A machine can be set up anywhere. We guarantee one to run for a year at least. Our model machine generates 110 volts of electricity and lights twenty lamps. The cost of maintenance is only the wear and tear. No fuel—simply keep the parts oiled and let it run."

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HALF-WATT LAMPS UNDER CONSIDERATION FOR BOSTON STREET LIGHTING.—In a recent report upon appropriation matters, the Boston Finance Commission states that if the sum of $150,000 is transferred from lighting to other purposes, the remaining $150,000 of the yearly appropriation for street-lighting equipment will be insufficient to provide the necessary new apparatus if the existing contract with the Rising Sun Street Lighting Company is terminated and electric lamps are substituted for gas lamps. The commission indicates that in the not distant future it will consider the half-watt nitrogen-filled lamp in comparison with gas and inverted mantle lamps for the illumination of streets now lighted by the Rising Sun company, the thoroughfares involved being those of minor importance in many parts of Boston proper.

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"ELECTRICAL AND LIGHTNING ENGINEERING."—Our attention has been called to a seventy-seven-page booklet of the above title, written by a certain Mr. Henry W. Spang (but issued without publisher's imprint, address or sponsorship of any kind) which is likely to be very misinforming to non-technical laymen in its treatment of the topics of electrolysis in underground construction and of lightning protection. Free use is made of names and citations of well-known electrical authorities, and from these the author draws original conclusions in support of his novel theory concerning "the aversion of electricity for a metallic circuit," although not always taking pains to distinguish his own views from those of the defenseless authority quoted. In the words of the preface: "The object of this work is to explain why electric light, power and railway engineering is now in its most destructive state." College textbooks, "electric engineers," professors of electrical engineering, accepted rules for standard electrical construction, and electrical authorities in general, are assailed in language bristling with such words as "lies," "nonsense," "blunders," "ridiculous," etc. Coming to a frank mention of names, Mr. Spang adds that "Neither can the employees of the General Electric, Westinghouse and other electric manufacturing companies who design and develop electrical apparatus be regarded as expert electrical engineers. There is quite a difference between an electric developer and a practical electric engineer." Another interesting statement, which, like some favorite refrain, is repeated without any particular cause or context at intervals throughout the book, asserts "that the great electric heat generated in the New York subway is mainly due to the aversion of the power currents to flow in metallic circuits, and especially while starting the long and heavy-laden trains!" The pages abound in such disconnected discourse, although one wonders, on the other hand, whether some sympathetic electrical readers will not find method in the author's madness revealed by such occasional observations as: "The lightning-rod man is generally regarded as a charlatan, while the individual who loads up the electrical circuits with lightning arresters and choke coils poses as a consulting electrical engineer." We do not know how widely Mr. Spang's book has been circulated, but while its fallacies are self-evident to all persons of even the most elementary electrical understanding, it is to be feared that the author's plausible language may impress laymen having no technical knowledge, municipal officials, etc., at whom the work evidently has been directed.

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SOCIETY MEETINGS

REJUVENATION OF DETROIT JOVIANS.—A rejuvenation of the Jovians of Detroit will take place at the Cadillac Hotel, Feb. 7, at which time 150 members will be initiated into the order.

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NATIONAL FIRE PROTECTION ASSOCIATION.—A Chicago chapter of the National Fire Protection Association has been organized, with Mr. Frank D. Chase as president and Mr. William S. Boyd, 76 West Monroe Street, as secretary-treasurer.

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EDITOR MEHREN TO SPEAK IN CHICAGO.—Mr. E. J. Mehren, editor of the *Engineering Record*, New York, will give an address on "The Making of a Technical Paper" before the Western Society of Engineers, Chicago, on the evening of Feb. 2.

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MERIT TEST TO SELECT CONVENTION DELEGATE.—The Public Service Company of Northern Illinois section of the N. E. L. A. will conduct a merit test for the selection of a delegate to represent the section at the coming Philadelphia convention. Candidates will submit articles pertaining to the company's business or to topics of general electrical interest. Contestants will also be judged upon their discussions of these papers as they are read before the section. At the Dec. 23 meeting of the section a paper on "The Inspection Department's Test Work" was read by Mr. R. V. Ward, and another entitled "Service" was read by Mr. F. H. Scheel.

CONVENTION OF IDAHO SOCIETY OF ENGINEERS.—The annual convention of the Idaho Society of Engineers will be held at Boise, Feb. 5 to 7. Electrically cooked luncheons will be served to members. A Jovian rejuvenation is among the features of the program.

* * *

IOWA ELECTRICAL CONTRACTORS TO ORGANIZE.—On Feb. 2 a meeting will be held in Waterloo, Ia., at which the electrical contractors of the State will organize a state association. Mr. W. J. Collins, Mr. Ernest Freeman and others from Chicago have signified their intention to attend the meeting.

* * *

DOINGS OF THE PHILADELPHIA JOVIAN ELECTRICAL LEAGUE.—On Jan. 29 the Jovian Electrical League held a luncheon at the Bingham Hotel, Philadelphia, at which an address was made by Mr. G. C. Foley, of the Divinity School. A rejuvenation of the Sons of Jove was held on Jan. 30 on the roof garden of the Continental Hotel.

* * *

ADDRESS ON FELLOWSHIP AT CHICAGO ELECTRIC CLUB.—Mr. John D. Shoop, assistant superintendent of Chicago schools, addressed the Chicago Electric Club Jan. 15 on the subject of "Fellowship." Ministration to the needs of humanity not with charity from a dollars-and-cents standpoint but with the ideal of spiritual help was the theme of the address.

* * *

NEW YORK JOVIAN LEAGUE.—At the Jovian League luncheon, Hotel Martinique, New York, Jan. 28, Mr. Hugh T. Wreaks, of the Wire Inspection Bureau, discussed problems of electrical building inspection in New York City, suggesting remedies for the conditions existing with respect to the large number of buildings reported unsafe electrically.

* * *

CHICAGO SECTION, ILLUMINATING ENGINEERING SOCIETY.—On Feb. 11 Sears, Roebuck & Company, Chicago, will tender a dinner to the members of the Chicago Section, I. E. S., and their guests, following which Mr. S. E. Church, electrical engineer for the company, will describe the elaborate electrical installation in the great buildings of the mail-order house.

* * *

PANAMA SECTION OF THE INSTITUTE.—The board of directors of the American Institute of Electrical Engineers having authorized a section to be known as the "Panama Section," a meeting of thirty-eight members, applicants and prospective members was held at the Hotel Tivoli, Canal Zone, in December. Mr. Edward Schildhauer was elected chairman and Captain W. H. Rose secretary-treasurer of the new section.

* * *

INDIANA ENGINEERING SOCIETY.—An interesting three-day program was presented before the members of the Indiana Engineering Society at Indianapolis, Jan. 22 to 24. Officers were elected as follows: President, Prof. Albert Smith, Lafayette, Ind.; vice-president, Mr. J. G. B. Short, Hillsboro, Ind.; secretary, Mr. Charles Brossmann, 1616 Merchants' Bank Building, Indianapolis, Ind.

* * *

MEETING OF DUQUESNE LIGHT COMPANY SECTION, N. E. L. A.—At a meeting of the Duquesne Light Company Section of the National Electric Light Association at the Colonial Hotel, Pittsburgh, Jan. 23, Mr. F. B. Patterson spoke on "The Inside Meter Department of the Laboratory," Mr. H. S. Calderwood on "The Skilled and Schooled Workers," and W. A. Donkin on "Increase of the Sales Department."

CHICAGO JOVIAN LEAGUE.—Mr. C. R. Hunt, of the Chicago office of the General Electric Company, gave an illustrated talk on "Electrical Equipment for Theaters" at the Chicago Jovian League luncheon on Jan. 26. Mr. H. E. Niesz, the presiding statesman, announced the appointment of Mr. Victor H. Tousley as chairman of the membership committee. Mr. J. Bennett, of Montreal, made a few remarks as a visiting Jovian.

* * *

ORGANIZATION DINNER, INTERNATIONAL ELECTRICAL CONGRESS.—An organization dinner for the discussion of plans for the International Electrical Congress at San Francisco in September, 1915, is to be held at the Engineers' Club, New York City, Wednesday evening, Feb. 25. Invitations will be issued to members of the Congress General Committee of 150, to members of committees of the American Institute of Electrical Engineers and to officers of the Institute and its sections.

* * *

AWARD OF OCTAVE CHANUTE MEDALS.—Octave Chanute medals have been awarded by the Western Society of Engineers for the best three papers presented during the year 1913 as follows: Mechanical and Electrical engineering, Mr. W. L. Abbott on "The Northwest Station of the Commonwealth Edison Company"; general engineering, Mr. Onward Bates on "Arbitration"; civil engineering, Mr. D. W. Mead on "The Cause of Floods and the Factors That Influence Their Intensity."

* * *

OFFICERS OF NEW YORK STATE ELECTRICAL CONTRACTORS' ASSOCIATION.—At the convention of the Electrical Contractors' Association of the State of New York held in New York City recently the following officers were elected: President, Mr. H. N. Smith, of Syracuse; vice-president, Mr. L. W. Wood, of New York City; secretary, Mr. G. W. Russell, of New York City, and treasurer, Mr. J. F. Burns, of Schenectady. The next annual convention of the association will be held in Troy, N. Y. Mr. M. L. Barnes, of Troy, was elected for the fifteenth consecutive year to represent the State association in the Board of Directors of the National Electrical Contractors' Association.

* * *

OFFICERS OF UTAH ELECTRIC CLUB.—The Utah Electric Club of Salt Lake City, which now has a membership of 440 and holds weekly luncheon meetings, has elected officers for 1914 as follows: Mr. W. W. Torrence, of the General Electric Company, president; Mr. William M. Scott, of the Utah Light & Railway Company, vice-president; Mr. B. W. Mendenhall, of the Utah Light & Railway Company, secretary and treasurer. Other directors elected are: Messrs. C. C. Campbell, of the Mountain States Telephone & Telegraph Company; Leo Brandenberger, of the Utah Power & Light Company; E. H. Eardley, of the Eardley Brothers Company; R. S. Folland, of the Capital Electric Company; H. W. Kline, of the Mountain States Telephone & Telegraph Company, and C. B. Hawley, of the Intermountain Electric Company.

* * *

JOINT MEETING OF GARAGE OWNERS AND CHICAGO SECTION, E. V. A.—Members of the Chicago Garage Owners' Association and of the Chicago Section of the Electric Vehicle Association of America held a joint meeting and luncheon at the Lexington Hotel, Chicago, Jan. 13, at which Mr. F. H. T. Potter, attorney for the Garage Owners' Association, spoke on the value of cooperation between the two societies whose interests are so nearly the same. Speaking from the standpoint of a

pleasure-car owner and a prospective purchaser of electric trucks, Mr. L. E. Hamburg, Chicago, said that he thought the excessive charges levied by the garage men on owners of pleasure cars for minor repairs produced an unfavorable impression in the minds of many business men who would otherwise buy electric cars for commercial purposes.

* * *

New York Section, A. E. S.—On Feb. 6, at the Chemists' Club, 52 East Forty-first Street, New York City, the New York Section of the American Electrochemical Society will hold a joint meeting with the local section of the American Chemical Society and the Society of Chemical Industry. Dr. Charles Baskerville will read a paper on "Opening Up the Field of Unused Elements," outlining uses for tellurium, selenium, cadmium, etc. Dr. H. T. Kalmus will present a paper on "Cobalt," and Dr. E. Weintraub, director of the Research Laboratory, General Electric Company, West Lynn, Mass., will read a paper entitled "The Present Status of Boron." Dr. R. W. Moore, of the same company's laboratory at Schenectady, N. Y., will close the program with an address on "The Present Status of Tungsten."

* * *

Delegate to Be Selected by Competition.—The Philadelphia convention delegate from the National Electric Light Association company section in Chicago and vicinity representing the Public Service Company of Northern Illinois will be selected as the result of a competition conducted on the merit basis. The member who receives the largest number of merit points will be adjudged the winner. Points will be awarded as follows: Two hundred for the best paper presented at each section meeting (all other papers being awarded points according to relative merit); fifty points for the best discussion (others getting a smaller number, according to merit); five points for each new member secured, and ten points for attendance at meetings. Provision was also made for thirty extra points to a member sending in a paper for the December (1913) meeting; fifteen extra points for a paper for the January meeting; ten extra points for a paper for the February meeting, and five extra points for a paper for the March meeting.

* * *

Pittsburgh Section, I. E. S.—The program prepared by the Pittsburgh Section of the Illuminating Engineering Society for the remainder of the season includes the following papers: Feb. 13, "Lighting of Railroad Yards," by Mr. A. C. Cotton, of the Pennsylvania Railroad, and Mr. Harold Kirschberg, of the Lighting Specialties Company; March 13, "Modern Gas Lighting," by Mr. S. B. Stewart, contract agent for the Consolidated Gas Company, Pittsburgh; April 17, "The Development of Flame Carbon Arc Lamps," by Mr. C. E. Stephens, of the Westinghouse Electric & Manufacturing Company; May 15, "The Illumination of Building Exteriors," by Mr. Ward Harrison, and "Engineering Features of Electric Sign Advertising," by a representative of the engineering department of the National Lamp Works of the General Electric Company; June 12, a lecture by Dr. John A. Brashear. The meetings will be held in the Oliver Building, Pittsburgh, at 8 p. m.

* * *

Convention of Western Pennsylvania Telephone Association.—The fifth annual convention of the Western Pennsylvania Telephone Association was held in Pittsburgh Jan. 23 and 24. Mr. J. Walter Barnes, president of the association, presided. At the opening session speeches were made by Mr. H. E. Webb, of Pittsburgh, and Mr. C. Phillips Hall, of the Doubleday-Hill Electric Company of Pittsburgh. Delegates to the recent national convention of independent companies read reports. A number of girl operators invited to the convention led in the discussion of "Handling the Service." Other speakers during the two days' sessions were: Mr. H. L. Lamb, California, Pa., on "The Value of Publicity"; Mr. J. C. Core, Jr., of Uniontown, on "The Toll Business"; Mr. T. J. Shuflin, of Butler, on "Building Good Toll Lines"; Mr. H. H. Bradley, of Philadelphia, on "The Female Labor Law"; Mr. W. S. Paca, of Oil City, on "Proper Maintenance"; Mr. W. H. Wilson, of Erie, on "Rural Lines," and Mr. E. D. Schade, of Johnstown, Pa., on "The Pennsylvania Public Service Commission."

* * *

Safety First.—At the meeting of the Chicago Section of the Electric Vehicle Association on Jan. 20 Mr. G. H. Whittle, president of the Public Safety Commission of Cook County, and Mr. Peter M. Hoffman, the coroner of Cook County, addressed the members on the subject of public safety. Mr. Whittle gave a statistical review of the "safety-first" movement and said that both legislation and education are needed to lessen the number of accidents. In relation to automobiles he said that traffic should be speeded up rather than slowed down. To do this pedestrians must be excluded from the roadways except at street intersections. The problem must be dealt with sanely, but it is true that the proportion of accidents due to automobiles is increasing, and the persistent speeder must be brought to justice. The coroner said that 70 per cent of accidents are due to carelessness of the public and 30 per cent to the recklessness of drivers, operators or owners. For automobile drivers who are confirmed "speed maniacs" jail sentences were recommended. Those interested in automobiles should see to it, in self-defense, that the reckless driver is put out of business.

* * *

New Officers of St. Louis League of Electrical Interests.—At the recent annual dinner of the St. Louis League of Electrical Interests, Jovian Chapter, there was an attendance of 225. Officers were elected as follows: President, Mr. H. J. Pettengill, president Southwestern Telephone & Telegraph Company; vice-presidents, Messrs. Frank D. Beardslee, sales manager Union Electric Light & Power Company, and Fred B. Adam, general manager Frank Adam Electric Company; secretary, Mr. Fred Johnson, district sales manager Wagner Electric & Manufacturing Company. Mr. W. N. Matthews, Jupiter of the Jovian Order, presided at the meeting until the election of officers, when Mr. Pettengill took charge and acted as toastmaster at the dinner. Mr. J. Von Mar, superintendent of the Laclede Gas Light Company, in a humorous speech presented to the retiring president, Mr. A C. Einstein, president of the Union Electric Light & Power Company, a badge of membership in a new order which seems to be exciting considerable attention in St. Louis. Other speeches were made by Mr. W. A. Layman, president of the Wagner Electric & Manufacturing Company; Gen. E. J. Spencer, of the National Guard of Missouri; Messrs. Sam A. Hobson, Western manager *Electrical World;* T. M. Meston, vice-president Emerson Electric Manufacturing Company; H. H. Humphrey, consulting engineer; F. N. Boyer, district manager of the General Electric Company, and Ell C. Bennett, Mercury of the Jovian Order. There was excellent music by the Union Electric orchestra, and motion pictures were shown. The league now has a membership of 763. Plans are already under way for the entertainment of the Jovian Order at the time of the annual convention in St. Louis next October.

Unified Electric Service in Lorain County, Ohio

Power plants, modern substations, 22,000-volt transmission lines and commercial methods of the central-station system serving Lorain and Elyria, Ohio

SEVERAL scattered electric-service properties in Lorain County, Ohio, on the southern shore of Lake Erie, west of Cleveland, have been consolidated during the past year and are now being operated as a modern interconnected central-station system. Formerly the various parts of the territory now served by this unified system received electrical energy from the Ore Dock power plant of the Baltimore & Ohio Railroad in Lorain, from the Citizens' Gas & Electric Company, Lorain and Elyria, from the Ely Realty Company, Elyria, and from the Elyria Milling & Power Company. The present organization, operating for the time being under the name of "R. E. Burger, Agent," is furnishing energy to the towns of Amherst, North Amherst, Berea and Olmstead Falls in addition to Elyria and Lorain. Since the reorganization some of the former generating stations have been rehabilitated while the operation of others has been discontinued, new substations and transmission lines have been erected, and every effort has been made to deliver efficient and reliable service to the company's patrons. Although the organization has yet to complete the first year of its existence, rapid strides have already been made in building up an industrial motor load on the system.

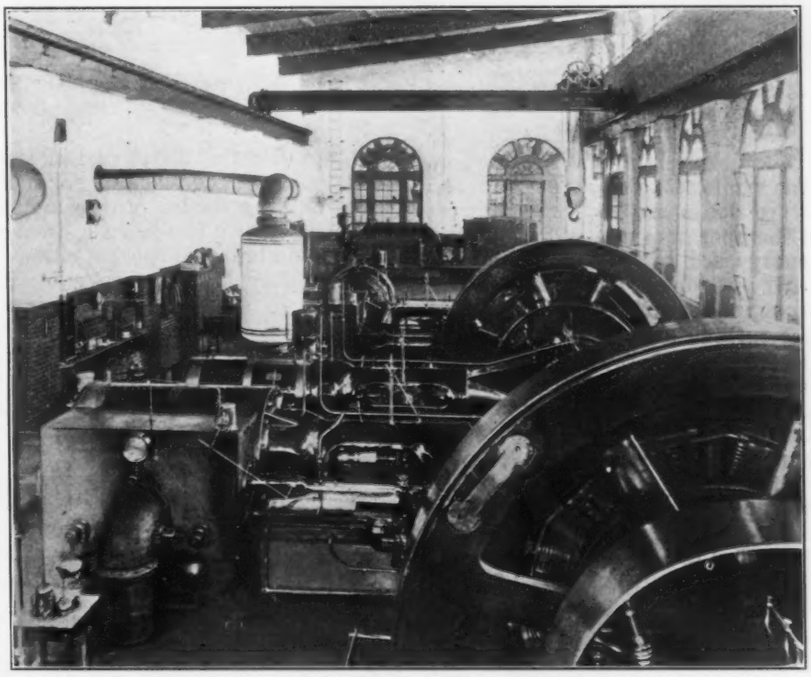


FIG. 1—INTERIOR OF ENGINE ROOM, ORE DOCK PLANT, LORAIN, OHIO

The property is owned by Henry L. Doherty & Company, New York, and pending the completion of the plans for re-incorporation now being prepared, the system, as above noted, is being operated under the name of "R. E. Burger, Agent," under which style all transactions have been carried on since the sudden death recently of Mr. George E. Milligan. Later it is expected that the name "The Lorain County Power Company" will be adopted.

The Ore Dock plant's equipment includes two 500-kw engine-driven direct-current units and one 2500-kva turbo-generator set. Each of the direct-current units is made up of a 500-kw, 250-volt interpole Westinghouse generator directly connected to a cross-compound Buckeye engine, the cylinder dimensions of which are 24 in. and 42 in. by 36 in. Both of these engines operate non-condensing and are provided with sliding cut-off piston valves. On acceptance test 125 per cent overload was carried on the generators and the engines developed 1562 hp. Their normal rating, however, is only 1040 hp. Since the energy furnished by these direct-current generators is used in driving the large ore unloaders on the dock, the demand for power sometimes fluctuates from zero to 125 per cent overload in a period of fifteen seconds. It will thus be seen that the additional specification which required the engines to maintain a regulation of 2 per cent from no load to full load and full load to no load was not without cause.

Practically all of the alternating-current load of the station is carried by the Westinghouse Parsons double-flow 2500-kva, 2400-volt, sixty-cycle turbo-generator, which operates at 3600 r.p.m. The steam end of this unit has been designed for 175 lb. pressure at 100 deg. superheat with 28-in. or 20-in. vacuum.

On the same platform with the turbine are mounted two direct-current units furnishing excitation energy. One of these sets consists of a Terry steam turbine driving a compound-wound 25-kw direct-current generator at 3000 r.p.m., while the other is an induction-motor-generator set operating at 2400 r.p.m. The latter exciter is also rated at 25 kw and 125 volts and was furnished by the Westinghouse Electric & Manufacturing Company. The vacuum for the turbine is carried by a Westinghouse Leblanc condenser of the latest type mounted in the basement just below the turbine. A 40-hp Westinghouse steam turbine operating at 1600 r.p.m. drives both the water pump and the air pump serving the condenser. Oil at 4-lb. pressure is delivered to the bottom of the turbine bearings by a rotary pump and on passing through the bearings is filtered, cooled and reused. An auxiliary steam reciprocating oil pump is used for emergencies and during periods of low speed at starting and stopping.

Near the east end of the station between the tur-

bine units and the engine-driven units two motor-generator sets have been placed. One of these is a 300-kw Allis-Chalmers machine, the direct-current end of which consists of a 300-kw, 250-volt, compound-wound dynamo designed to operate either as a motor or a generator. The alternating-current end consists of a synchronous motor or generator designed for 440-volt operation. A 25-kw exciter unit is mounted on the same shaft and the whole set operates at 600 r.p.m. At times when the ore docks are not unloading or loading a vessel but the operators at the docks desire small amounts of energy for testing purposes, this unit is operated as a synchronous motor and direct-current generator to supply the 250-volt energy. At other times, when the turbine needs overhauling and cleaning or at times of light load, 250-volt direct-current energy is taken from the engine-driven unit through the direct-current end of this motor-generator set and delivered to a bank of transformers at 440 volts. Here it is stepped up to 2300 volts for distribution about the city of Lorain. Thus, at periods of light load, this unit equipped for duplex duty supplies the demands of the system, relieving the larger units and effecting a saving in efficiency over that of the large machines at light load. Near by is a 500-kw Crocker-Wheeler motor-generator set converting 250-volt direct current into 2300-volt alternating current.

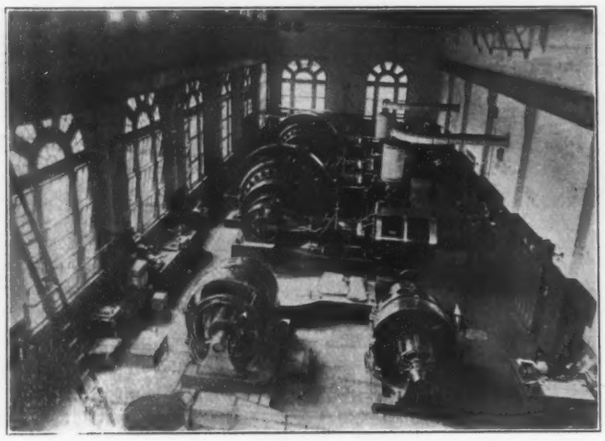


FIG. 2—MOTOR-GENERATOR SETS AND ENGINE UNITS, LORAIN PLANT

FIG. 3—HYDROELECTRIC STATION, DAM AND FALLS AT ELYRIA

The switchboard in the west end of the station consists of fourteen panels of blue Vermont marble and with its instruments was furnished by the General Electric Company, Schenectady, N. Y. Thompson astatic ammeters with 4000-amp scales and illuminated dials indicate the individual output of the generators. All of the direct-current panels are provided with double-throw switches so that the buses may be sectionalized and the fluctuating load carried separately from the other direct-current output. Thompson watt-hour meters rated at 250 volts and 3000 amp record the outgoing energy. Carbon-break equalizer switches for the direct-current units are placed on pedestals near the machine for handier operation. A speed-limiting device on the motor-generating set is arranged to trip the latter's breaker. Since this machine is designed to operate either as a direct-current or as an alternating-current set, a double-throw switch has been provided to maintain correct polarity at the wattmeter.

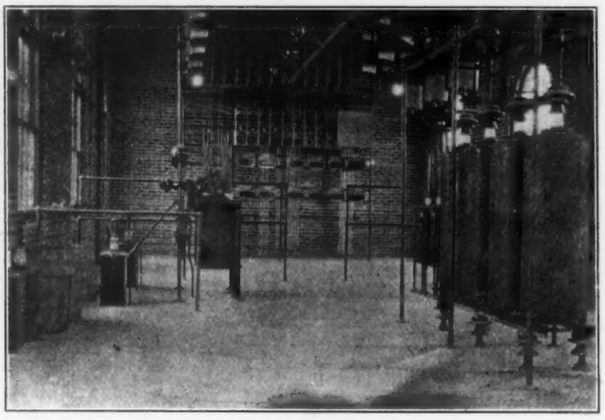


FIG. 4—LIGHTNING-ARRESTER GALLERY, ELYRIA SUBSTATION

Both exciters serving the 2500-kva turbine are controlled from one panel carrying three instruments at the top. Only one voltmeter is needed, since a double-throw switch has been installed which allows the potential of either machine to be read from this instrument.

The swinging panel shown supports a synchroscope, sychronizing lamps, a frequency indicator and a voltmeter. Below this swinging bracket on a small auxiliary panel is the Tirrill regulator for the main alternating-current circuit. A ground detector lamp is mounted above each instrument. The framework of the board is constructed of iron pipe spaced about 6 ft. from the wall so that there is ample room for wiring and other work behind the board.

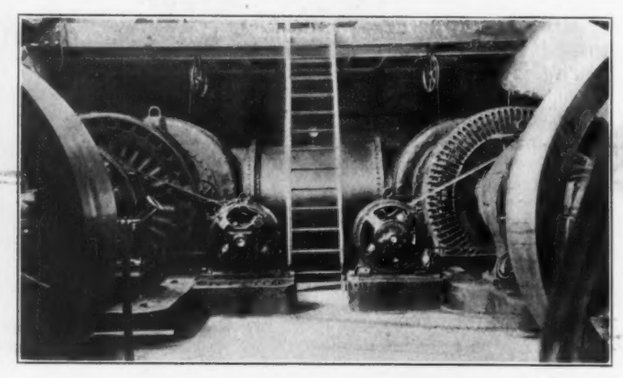


FIG. 5—WATERWHEELS, ALTERNATING-CURRENT AND DIRECT-CURRENT GENERATORS

As a feature of economical operation, the oiling system used in connection with the two 500-kw direct-

current engine-driven units is of interest. By means of this home-made system devised by Mr. W. C. Worley, chief engineer of the plant, oil from these engines is used over again many times. From the bearings of the machines the oil is taken to a separator where, after the water is removed, the lubricant is conducted through a filter to receiving tanks. From these tanks pumps lift the oil to overhead closed tubular tanks, which deliver the oil to the bearings at about 8 lb. per sq. in. When filled this oiling system contains about eleven barrels of oil, and about two barrels per year are needed for replenishing. Before the present filtering scheme was installed the two engines, it is said, used approximately fifteen barrels of oil per year.

Steaming Equipment

The steam generating equipment of the station consists of five 260-hp Babcock & Wilcox boilers and three 400-hp units built by the same manufacturers. The five smaller boilers made up the original Baltimore & Ohio installation and they now carry steam pressure at 175 lb. per sq. in. Steam pressures of 175 lb. per sq. in. with 100 deg. superheat are carried on the three newer units. All boilers are hand-fired and are equipped with McClave shaking grates. The firing

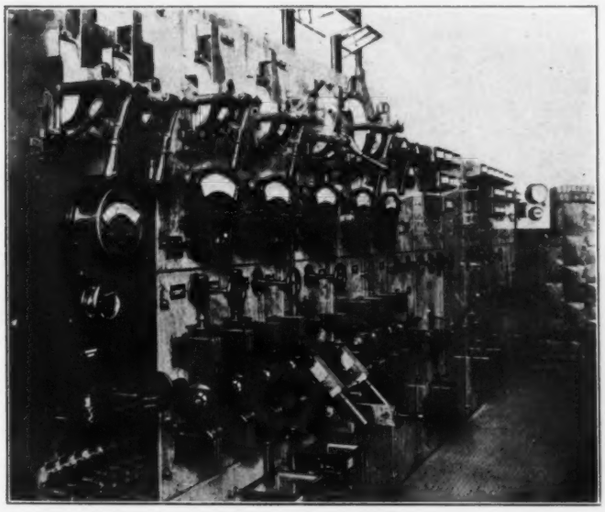


FIG. 6—SWITCHBOARD IN LORAIN STATION

doors on the entire bank of boilers face the side of the power house nearest the lake. Coal is brought in hopper-bottom cars to this side of the plant on a coal tipple track elevated 9 ft. above the boiler-room floor. These cars are dumped into 350-ton bunkers and the fuel travels by gravity to the furnace room, where it is shoveled directly into the furnace doors.

In order that the feed-water pumps may be independent of all other steam-driven equipment in the station, non-return stop valves have been installed on the lines serving these pumps. The high-pressure steam-pipe work has all been built for 200-lb. steam pressure, and where practicable long sweeps have been employed in the pipes instead of short bends or elbows. All boilers are connected to a common header. The blow-off equipment consists of Simplex blow-off valves used in conjunction with quick-opening valves.

Feed water is brought to the boiler by a loop system which is so arranged with valves and by-passes that any boiler may be cut out of the line in case of trouble or for cleaning while the other units are still in operation. At present feed water is secured from the city mains, but later arrangements will be made to take water from Lake Erie through a still-well and open feed-water heater. With the present arrangement water is delivered through a turbine-driven Platte centrifugal boiler-feed pump operating at 3000 r. p. m. to a Platte feed-water heater of 3000-hp rating, where it is raised to a temperature of 212 deg. Fahr. The feed-water heater is situated above the boiler and

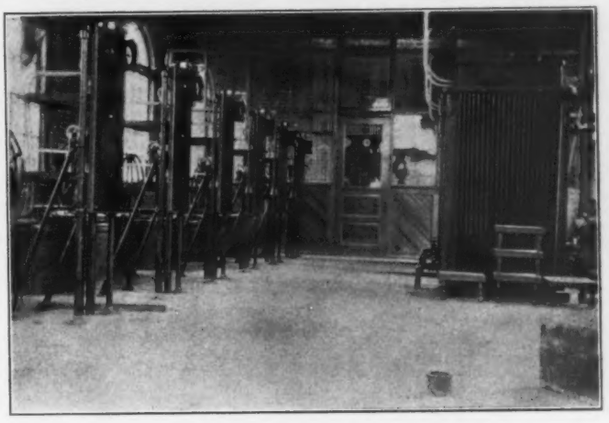


FIG. 7—FIRST FLOOR, ELYRIA SUBSTATION

gives a 16-ft. head on the pumps. As an emergency unit a Worthington reciprocating duplex pump is kept at hand which is large enough to handle water for the entire plant. The depth of water in the boilers is made known to the firemen through Reliance water columns. High-water and low-water alarms used in connection with these devices serve to warn the operator against dangerous conditions existing in the boilers. All live-steam, feed-water and drip pipes are lagged with 1.5 in. of heat-insulating material consisting of 95 per cent magnesia. Although the normal rating of the boilers in this plant is but 2500 hp, it is said that under overload conditions they will develop 3500 hp.

The entire bank of eight boiler units is connected to a common breeching which conducts the gases to a Custodis brick stack. This stack is 7.5 ft. in diameter, stands 187 ft. above the grates of the furnaces and has been designed to furnish draft for 2500 hp in boiler rating.

FIG. 8—SANDSTONE QUARRY NEAR ELYRIA

The original designs for this station were drawn by Mr. J. H. Davis, engineer for the Baltimore & Ohio Railroad Company.

Hydroelectric Station in Elyria

The power plant in Elyria, known as the hydroelectric station, is in reality a combination gas-engine

and water-power plant. Here two alternating-current 200-kw, 2300-volt, three-phase, sixty-cycle Westinghouse alternators and two direct-current 50-kw, 110-volt Westinghouse generators are connected by shafting so that they may be driven by either two Triumph waterwheels or by two Rathbun-Jones 350-hp gas engines.

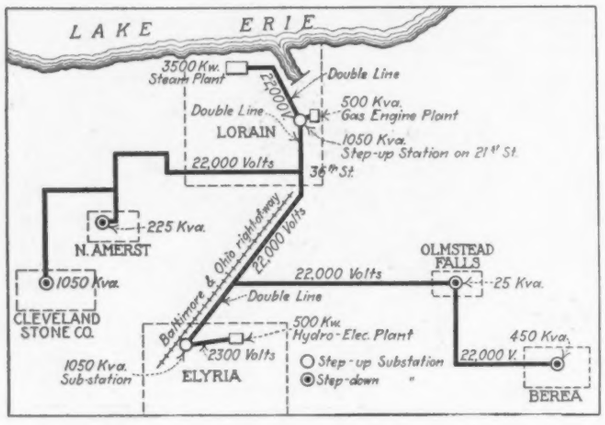


FIG. 9—MAP SHOWING LINES AND STATIONS

Although not of very large rating, this station has many interesting features. First among these may be noted the construction of the building itself, for two of its walls are formed from the natural unhewn rock of the cliff. The location of the station in relation to the city is also unique, for the waterfall, the dam and the power site are within one square of the heart of the city of Elyria. The plant operates on a 62-ft. head, 50 ft. of which is produced by the natural fall shown in the illustration.

At the time of the Ohio floods in March, 1913, water poured over these falls in torrents and at its highest stage was rushing over the roof of the power house. A dam which formerly stood nearer the falls and a bridge on one of the main streets of Elyria, just back of the present dam, were both carried away. At this time new generators were shipped by express from the Westinghouse works at East Pittsburgh, Pa., and service was resumed in a remarkably short time. Even while the water was still standing in the power house, tub transformers for street lighting had been shipped and were put into operation in a shed not far from the hydroelectric plant.

When the flow of Black River is sufficient, the alternators and the direct-current generators are connected to the Triumph waterwheels. At other times, when the generating equipment is needed and insufficient water is at hand for its operation, the gas engines at the opposite end of the line shafting from the waterwheel are connected to the generating equipment to carry the load. Again, there are other periods when the operation of this plant is not required for carrying alternating-current loads, and then the alternating-current generators are connected to the mains of the system and operated as synchronous motors. This expedient has been found very successful in improving the general power-factor of the system. The direct-current output supplied at such times furnishes energy to direct-current customers who were formerly on the old circuits and have never been changed over to the alternating-current mains.

Substation in Elyria

One of the newest additions to the company's property is the modern 1050-kva substation in the outskirts of Elyria. Here three 350-kw, 2200/22,000-volt transformers connected in delta on tubular busbars are provided for handling commercial load. The station has been designed and wired so that at any time the system may be changed to 33,000-volt operation. In addition to transformers carrying commercial loads there are seven tub transformers with individual panels each supplying fifty series arc lamps taking 4 amp apiece.

On the second floor of the substation are the lightning arresters and the high-tension switches supported upon iron-pipe framing. White-asbestos wiring has been used throughout the entire substation, with the result that circuits stand out clearly and present a pleasing appearance to the eye. The lightning arrester and machine-switch equipment are also arranged so that they may be transferred at any time to 33,000-volt operation. For both the high-tension and distribution circuits entering and leaving the building neat racks constructed of wood substantially braced and anchored have been provided.

At the power house in Lorain there has just been erected a step-up transforming substation containing three 1500-kw, 2400/22,000-volt water-cooled Westinghouse transformers with duplicate switching and lightning-protective apparatus. The building is of brick and steel and has been made to conform with the architecture of the main station. From this substation to the Lorain city limits a 23,000-volt steel-tower transmission line has been erected, with duplicate conductors, lightning protection and telephone circuit.

Other Substations

Connected to the transmission lines of the company, there are altogether seven generating stations, one step-up transformer station and six substations in which energy is stepped down from high voltage to distribution pressure. Eventually, the 500-kw gas-engine-driven plant in the outskirts of Lorain will be discontinued. At present the six step-down substations are rated as follows: Cleveland Stone Company (Amherst), 1050 kva; North Amherst, 225 kva; Olmstead Falls, 50 kva; Berea, 450 kva; Elyria, 1050 kva, and Lorain, 1050 kva.

FIG. 10—MOTOR-OPERATED ORE BRIDGE NEAR POWER HOUSE

Both the substation at the works of the Cleveland Stone Company and the one at Berea supply energy for motor service alone. What are said to be the largest sandstone quarries in the world are situated in the vicinity of Lorain, and the local electric-

service company has found the quarry owners ready users of electrical energy. The Cleveland Stone Company not only quarries its own stone, but is also engaged in the manufacture of grindstones and grindstone frames, so that the motor applications on their properties cover a varied field. Substations at North Amherst and Olmstead Falls supply energy for lighting and for motor service to the suburban and rural communities thereabouts.

Transmission Lines

An excellent idea of the typical 22,000-volt transmission structures of the company may be gained from the accompanying illustration taken near the three-way junction along the right-of-way of the Baltimore & Ohio Railroad between Elyria and Lorain. In all cases the lines are carried on 40-ft. celar poles with 8-in. tops.

The sectionalizing switch rack is built of poles of the same height and is braced with pine timbers measuring 4 in. by 4 in. Steel messenger wire is also liberally used in bracing this structure. As will be noted from the illustrations, ground wires are carried

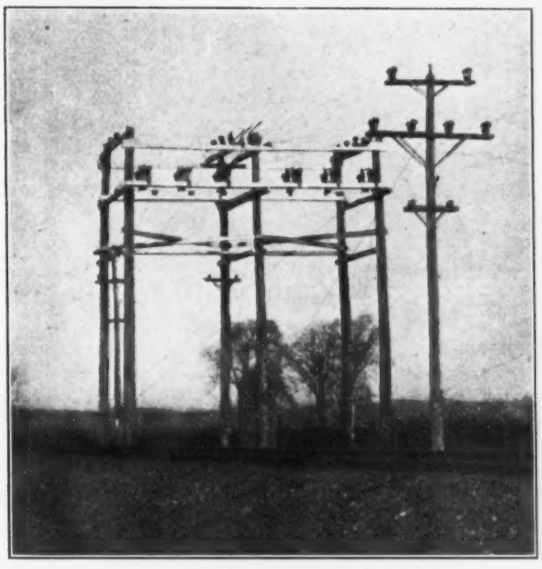


FIG. 11—TRANSMISSION-LINE CONSTRUCTION, SHOWING SWITCH RACK

on brackets above and below the high-tension circuits, and on the small arm about 6 ft. beneath the lower high-tension arms an emergency telephone line has been strung. A booth beneath the sectionalizing switches contains a telephone for signaling substations and generating plants.

New-Business Methods and Results

Although only a short time has elapsed since the consolidation of the electric-service companies under the present organization, the new-business department has been actively at work. Within the last three months nearly 200 residences in and about Lorain and Elyria have been wired for electric service. In securing house-wiring business the company's solicitors call on citizens and, if possible, induce them to sign contracts for wiring. The prices set down in these contracts are based upon estimates made from a set schedule agreed to by the company and all the contractors in the city. Contractors do the wiring, receiving payment from the company immediately upon the completion of the job. The company is paid 20 per cent of the cost of installation by the customer immediately after the job is finished, while the remainder is paid in ten equal monthly payments. Should the householder wish to take advantage of a discount for cash payment, 10 per cent is allowed if the full cost of installation is paid within ten days after completion of the work. Thus far this scheme of financing customers unable to pay for an extra wiring installation has proved very satisfactory.

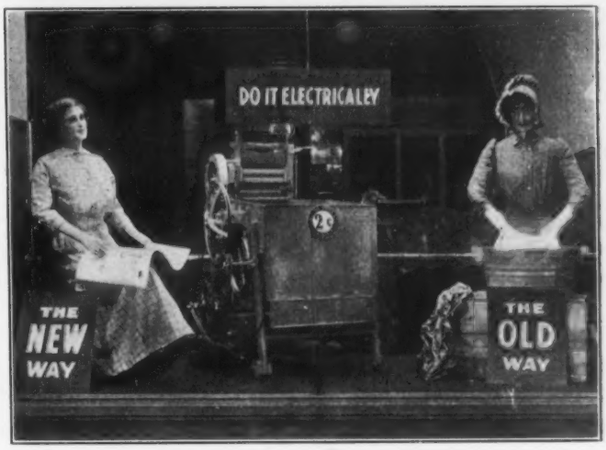


FIG. 12—WINDOW DISPLAY, ELYRIA, OHIO

In the company's office and display room, facing the public square, attractive window displays advertising electric appliances and motor-driven devices are kept continuously before the public. One of these displays exploiting "the new way" and "the old way" of doing a Monday's washing is shown in an accompanying illustration. Prominent place is given to the statement that the washing machine may be operated one hour at a cost of only 2 cents.

Thus far the efforts of the motor salesmen in the commercial department have been confined largely to connecting up stone quarries and manufacturing auxiliaries. How well they have succeeded may be judged from the statement that at present one of these companies has a connected load of nearly 3000 hp. A view of a portion of one of these quarries which conveys some idea of the scale of the works is reproduced herewith. Besides the sandstone quarries there are in the territory served a large steel plant, ship-building yards, several automobile factories and the ore docks already mentioned.

The present organization is under the direction of the general manager, Mr. R. E. Burger, who in his work is assisted by Mr. M. L. Derge, general superintendent; Mr. H. N. Becket, secretary; Mr. H. G. Bonner, commercial manager; Mr. L. Bartlett, construction engineer; Mr. R. W. Curran, superintendent of distribution, and Mr. C. G. Kiefer, superintendent of transmission lines. At the main steam plant Mr. W. C. Worley is chief engineer and Mr. C. B. Pierce is foreman of construction.

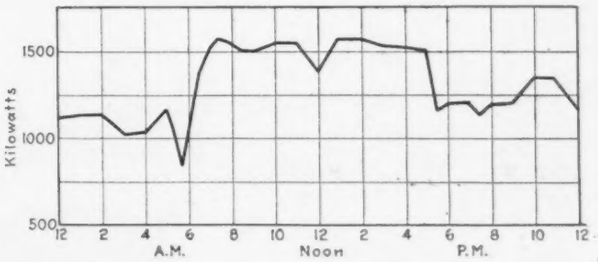


FIG. 13—TYPICAL LOAD CURVE AT THE LORAIN PLANT

Largest Motor-Driven Irrigation Pumping Plant

Nine centrifugal-pump units, aggregating 5685 hp. which can deliver 200,000,000 gal. per day to the 30,000-acre Gem irrigation district in western Idaho

THE Gem irrigation district in western Idaho comprises an area of 30,000 acres occupying one of the higher coves in the valley of the Snake River and having an altitude of approximately 2300 ft. above sea level. Its westerly edge is at the Oregon boundary, from which it stretches eastward into Idaho for a distance of 18 miles, skirting the south bank of the Snake River.

Since May of last year the lands of the Gem district have been made usable and fruitful with water from the Snake River, lifted electrically into the canals of the elevated plateau by the two pumping stations of the Crane Falls Power & Irrigation Company. The Gem installation, which includes the largest motor-driven irrigation pumping plant in the world, consists of nine motor-driven pumps arranged in four batteries. Three pumps lift the water to an elevation of 175 ft., two to an elevation of 100 ft., and two to 60 ft. The two pumps installed in the smaller station lift the water 104 ft.

When all of the foregoing pumps are in operation they will absorb 5685 hp, which is equivalent to the output of the largest of the water-power electric generating stations in this part of Idaho. The immediate needs of the district, however, require something less than 1500 hp even when sufficient head of water is running in each of the four canals. The entire output of all the pumps is approximately 200,000,000 gal. per twenty-four hours, a supply so large it is of interest to note that, allowing a per capita consumption of 75 gal., this installation would care for the needs of a city of 3,000,000 people.

The soils of the district are of five varieties, although the greater part of the land consists of volcanic ash. Several watercourses traverse the district and have deposited in their beds considerable alluvia. The greater portion of the remainder of the tract may be classed as wind-blown or eolian, and the fertility of the entire area is well shown by its present vegetation.

History of the Project

The Gem project was organized under the state law providing for the formation of irrigation districts, the development being financed by a bond issue which, when all phases of the project shall have been taken care of, will not exceed $28 per acre. For three years, moreover, enough electric energy has been guaranteed to the district free of all cost to permit operation of the pumps for the estimated requirements, while for the same period the interest charges are also exceedingly moderate, averaging only 20 cents per acre.

The present project was first undertaken in August, 1911, by Canadian interests acting through the Crane Falls Power & Irrigation Company, Ltd., whose engineers, Smith, Kerry & Chace, of Toronto, have been in charge of the design and construction of the works now built and in operation in the district.

In 1912 the canals were excavated and the pumping stations built. In the latter 40,000-volt energy taken from the lines of the Idaho Railway, Light & Power Company is transformed into mechanical energy to drive the nine huge centrifugal pumps which were supplied by Henry R. Worthington, Harrison, N. J. Leading from the pumps to the four canals are great wood-stave conduits, the largest being 4 ft. 6 in. in diameter and the smallest 3 ft. in inside diameter. These conduits contain 9662 linear ft. of pipe, some of which operates under pressures as high as 75 lb. per sq. in.

The two Gem pumping stations have a combined

FIG. 1—MAIN PUMPING STATION, GEM IRRIGATION DISTRICT, WESTERN IDAHO

pumping output of 292 cu. ft. per second, which, as already noted, is equivalent to approximately 200,000,000 gal, per twenty-four hours. These pumps take their water supply from the Snake River and discharge into four different lifts. The A canal covers a territory

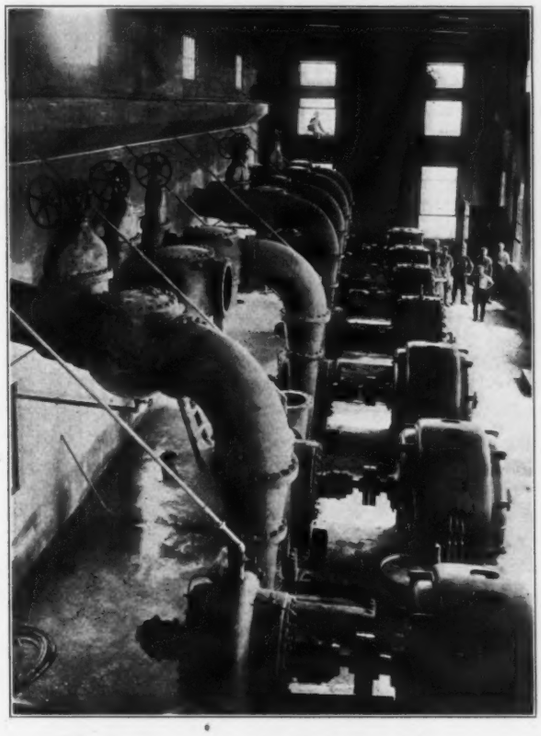


FIG. 2—INTERIOR OF MAIN PUMPING STATION, SHOWING LARGE CENTRIFUGAL PUMP UNITS

of 1176 acres and has 1225 stations 100 ft. apart; the B canal covers 7916 acres and has 693 stations 100 ft. apart; the C canal covers 6244 acres and has 596 stations 100 ft. apart; the D canal has 176 stations 100 ft. apart and empties into a patch canal 1¼ miles long, covering an area of 2805 acres.

Station No. 1, the larger of the two pumping plants, contains seven pumping units—the A pumps, of which there are three 18-in. sets, each discharging 38 cu. ft. per second against 177-ft. head and driven by a 1100-hp motor; the B pumps, of which there are two 20-in. sets,

TABLE I—RESULTS OF TEST OF 20-IN. "B2" PUMPING SET

Weir reading	19.85	19.8	19.8	19.8	19.2	19.15	18.19	17.75	17.65	0
Corrected reading	12.55	12.5	12.5	12.5	11.9	11.85	11.6	10.45	10.35	0
Gal. per minute	19,460	19,380	19,380	19,380	18,100	17,900	17,300	14,830	14,550	0
Corrected gal. per minute	20,100	20,000	20,000	20,000	18,700	18,500	17,850	14,830	14,550	0
Cu. ft. per second	44.7	44.5	44.5	44.5	41.6	41.2	39.7	33	32.35	0
Amperes	153	157	157	153	152	150	151	138	141	60
Volts	2,050	2,040	2,080	2,080	2,180	2,200	2,190	2,120	2,100	2,140
Power-factor	85	85½	85	85	86	86	87	83	84	85
Electrical hp	618	635	644	628	600	610	650	565	575	253
Mechanical efficiency	92	92	92	92	92	92	92	91	91	87
Brake hp	569	584	592	578	552	562	598	515	523	221
R.p.m.	673	675	676	676	665	664	685	667	665	705
Discharge pressure, lb	39	39	39	39	45	45	45	48	48	51
Discharge pressure, ft	90	90	90	90	104	104	104	111	111	117½
Total head	96	96	96	96	110	110	110	117	117	123½
Water hp	487	485	485	485	....	515	495	....	....	....
Efficiency	85.5	83	82	83.8	....	82.8	....	82	....	....

each delivering 43 cu. ft. per second against 108-ft. head and driven by a 750-hp motor, and the C pumps, of which there are two 20-in. units, each discharging 30 cu. ft. per second against 70-ft. head and connected to a 350-hp motor. The D units are located in Station No. 2 and consist of two 14-in. pumps, each discharging 16 cu. ft. per second against 110-ft. head.

The official tests on the pumping equipment of the Gem project were run off between May 30 and June 6, 1913. The water was measured over Cippoletti weirs,

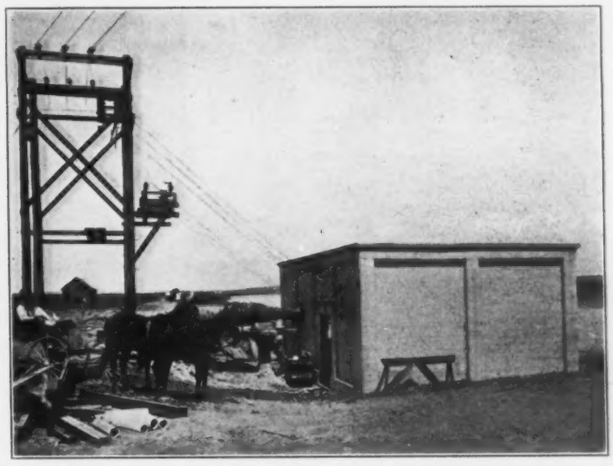


FIG. 3—HIGH-TENSION ENTRY AND PUMPING STATION NO. 2

which are of the trapezoidal type, levels being determined by means of hook gages. Corrections were made

TABLE II—RESULTS OF TEST ON 18-IN. "A3" PUMPING SET

Weir reading	16.5	16.5	16.5	16.5	16.5	16.25	14.95	14.9	....
Corrected reading	11.4	11.4	11.4	11.4	11.4	11.15	9.85	9.8	0
Gal. per minute	16,800	16,800	16,800	16,800	16,800	16,280	13,640	13,380	0
Corrected gal. per min	17,250	17,250	17,250	17,250	17,250	16,600	13,640	13,380	0
Cu. ft. per second	38.3	38.3	38.3	38.3	38.3	36.95	....	29.75	0
Amperes	233	233	233	233	233	231½	208	213	120
Volts	2,120	2,120	2,120	2,190	2,180	2,200	2,190	2,190	2,330
Power-factor	87	87	87	85	86	83	86	86	79
Electrical hp	995	995	995	1,015	1,010	....	900	918	....
Mechanical efficiency	92	92	92	92	92	92	91	91	....
Brake hp	916	916	916	934	930	905	825	845	....
R.p.m.	872	873	865	870	871	872	874	870	900
Discharge pressure, lb	70	70	70	70	70	75½	86	86	90½
Discharge pressure, ft	161½	161½	161½	161½	161½	172½	199	199	209
Total head	168	168	168	168	168	180½	205	205	215
Water hp	729	729	729	729	729	757	705	692	0
Efficiency	79.7	79.7	79.7	78.2	78.5	83.7	86	82.7	....

for velocity of approach. The formula used to measure the discharge over the weirs is: $D = 3.33\ LH^{3}/_{2}$.

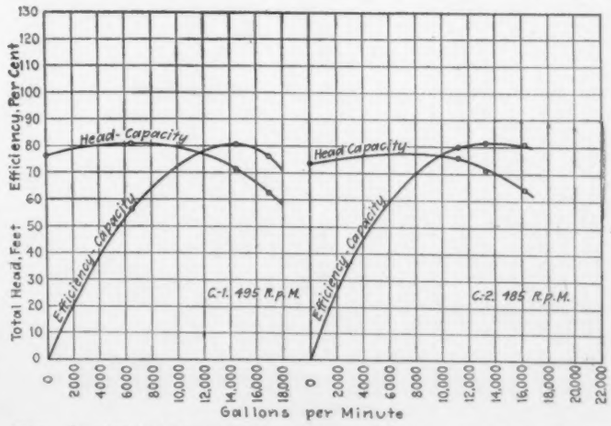


FIG. 4—CHARACTERISTIC CURVES, 20-IN. DOUBLE VOLUTE PUMPS

The discharge pressure on the pump was taken by means of a pressure gage, and the electrical input was measured by the station instruments, consisting of a voltmeter, an ammeter and a power-factor meter.

The power conditions during the test were not

altogether satisfactory, as there was considerable variation in both voltage and frequency.

The accompanying tables and curves of average results show that the pumps exceeded their guarantees in both efficiency and capacity in all cases except that of one of the A pumps, which was 600 gal. short, possibly owing to unsteady power conditions. The excess capac-

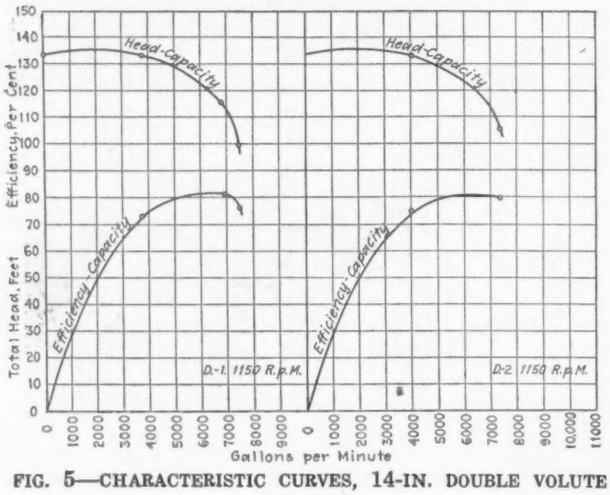


FIG. 5—CHARACTERISTIC CURVES, 14-IN. DOUBLE VOLUTE PUMPS

ity given by the whole installation totals, however, approximately 4500 gal. per minute. On the A and B pumps the efficiency guarantee was 80 per cent, while on the C and D sets it was 79 per cent. These guarantees were exceeded in all cases.

Rock River Hydroelectric Station Being Built on Government Dam

When the United States government constructed its new 1335-ft. dam across the Rock River at a point 0.75 mile above the city of Sterling, Ill., to divert water into a feeder for the "Hennepin," or Illinois & Mississippi Canal, it was generally conceded that injury would be done to the water rights of the Sterling Hydraulic Company, which owned a dam on the same stream at Sterling. As a recompense for the damage to the existing water rights the government granted the Sterling Hydraulic Company permission to erect a power station

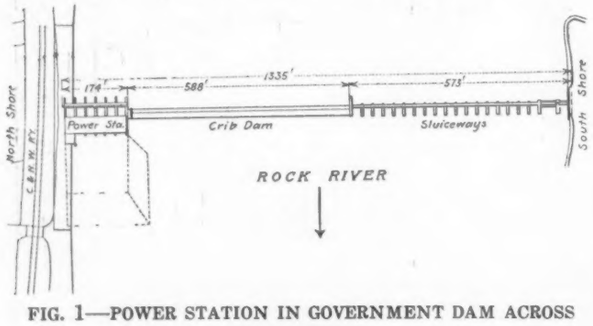


FIG. 1—POWER STATION IN GOVERNMENT DAM ACROSS ROCK RIVER

at the north end of the new dam, as shown in Fig. 1. These rights have now been leased for a period of twenty-five years, with the option of twenty-five years additional, to the Rock River Light & Power Company, and a station is in process of erection on the government dam site.

The river at this point measures 1335 ft. in width, and of this distance the eighteen sluiceways and lock occupy 573 ft., the spillway 588 ft., and the power house itself 174 ft. The contour of the riverbed here is such that both the wheel pits and the tailrace have had to be blasted from solid rock. Flowage through the sluiceways at the south side of the dam is controlled by means of counterweighted Tainter gates. The erection of this dam has created a pondage of 2230 acres over which the average depth of water is 8 ft. Inside dimensions of the station proper are 50 ft. by 168 ft.

On an 80 per cent power-factor basis the ultimate rating of the station will be 2250 kw. The equipment will be installed in six star-connected units rated at 375 kw, 2300/4000 volts and sixty cycles, operating at 60 r.p.m. All units will be of the vertical type with the 60-ton rotating elements supported from cast-iron hung-bearings. One governor will be installed for each two units. Electrical and waterwheel equipment is to be supplied by the Allis-Chalmers Company, Milwaukee.

Mr. H. S. Green, Sterling, Ill., general manager of the Rock River Light & Power Company, is in charge of the construction work on the power house. Jacobson & Ackerman, architects and engineers, Minneapolis,

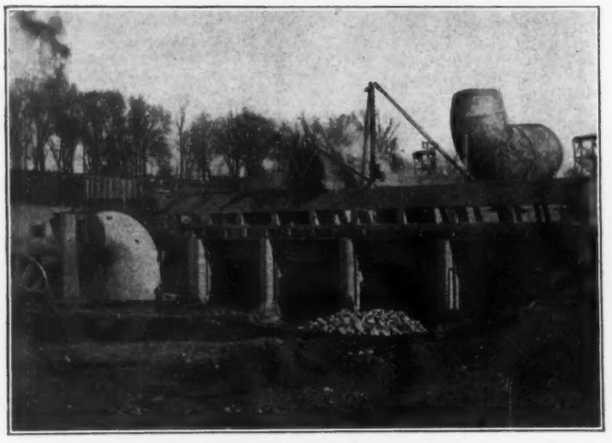


FIG. 2—WATER-POWER PLANT UNDER CONSTRUCTION AT STERLING, ILL.

Minn., are the contractors for making the excavations; A. Bolter's Sons, Chicago, for the structural steel work, and the H. A. Peter Company, Chicago, for the erection of the station building.

A 425-Mile Transmission Project in California

Mr. William E. Groff, manager of the Coachella (Cal.) Valley Ice & Electric Company, announces that his company has completed negotiations for the wholesale purchase of electrical energy from the Bishop station of the Southern Sierras Power Company. A 35-mile transmission line will be built from Banning to San Bernardino, connecting the existing lines of the Coachella and the Southern Sierras system. From Coachella the transmission line will also be extended 150 miles to the south, where it will connect with the present system of the Holton Power Company, operating in and about El Centro. From the water-power station at Bishop to El Centro is a distance of about 425 miles, so that the connecting links about to be built will complete one of the longest transmission lines in the world. Although no definite decision has yet been reached, it is thought that the line from Banning to El Centro will be carried on wooden poles. The transmission potential will be 55,000 volts.

Calculations for Alternating-Current Coils

Development of a formula for the inductance of a coreless solenoid, and description of tests to determine pull of alternating-current electromagnets

The Inductance of Air-Cored Solenoids

BY LEONARD A. DOGGETT

In what follows the author aims to present in the least possible space a universal formula for the inductance of an air-cored solenoid. Owing to the excellent work of the Bureau of Standards, much of the necessary information has already been gathered into one place.[1] The demand for a condensed summary of this work is evidenced by the work of Prof. Morgan Brooks.[2] At the present time air-cored solenoids find application as current-limiting reactances in central-station work and as tuning coils in wireless telegraphy.

Formula

The formula offered for the inductance of an air-cored solenoid is

$$L = N^2 a(A - B) \times 10^{-9} \text{ henries}$$

where

N = total number of turns

a = mean radius of coil in centimeters

A = a function of the ratio

$$\frac{\text{Mean radius}}{\text{Length}} = \frac{a}{l}$$ and is given by curve A

B = a function of the ratio

$$\frac{\text{Winding depth}}{\text{Length}} = \frac{c}{l}$$ and is given by curve B.

The accompanying curve sheet is self-explanatory and contains a sample calculation.

Experimental Comparison

In order to test the accuracy of the formula, comparisons were made between the calculated and measured values of inductance for fifty coils. The data on four-

TABLE I—CALCULATED AND MEASURED VALUES

Reference No.*	Number of Turns	Mean Rad. a, in Cm.	$\frac{a}{l}$	$\frac{c}{l}$	Calculated L, in Henries	Measured L
1	144	45.1	0.987	0.583	1.39 x10^{-2}	1.481 x10^{-2}
1	126	43.18	0.945	0.556	1.012x10^{-2}	1.074 x10^{-2}
3	2	4.97	22.25	0.425	0.115x10^{-6}	0.1092x10^{-6}
2	784	6.19	1.932	1.00	7.57 x10^{-2}	7.574 x10^{-2}
3	8	1.505	1.545	0.098	0.243x10^{-6}	0.2479x10^{-6}
2	594	3.25	1.0833	0.53	1.865x10^{-2}	1.8476x10^{-2}
4	30	6.5	0.507	0.0162	0.795x10^{-4}	0.82 x10^{-4}
3	20	0.98	0.227	0.0221	0.287x10^{-6}	0.2867x10^{-6}
3	24	0.98	0.1885	0.0181	0.348x10^{-6}	0.3458x10^{-6}

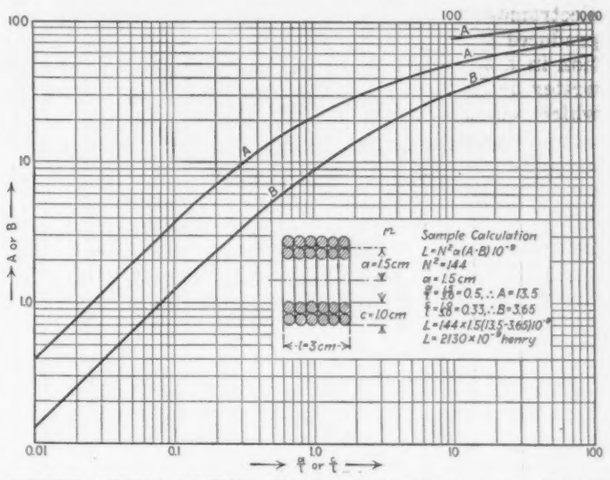
teen of these are shown in Tables I and II, the aim having been to select values of $\frac{a}{l}$ and $\frac{c}{l}$, not those that happened to yield the most accurate result, but those that covered as wide a range of these ratios as possible. The average inaccuracy for the fifty coils was about ± 2 per cent.

TABLE II—CALCULATED AND MEASURED VALUES

Reference No.*	Number of Turns	Mean Rad. a, in Cm.	$\frac{a}{l}$	$\frac{c}{l}$	Calculated L, in Henries	L, Calculated by Brooks Form
2	80	3.18	2.5	3.2	2.79 x10^{-4}	2.89x10^{-4}
2	50	5.08	4.0	2.0	3.01 x10^{-4}	3.01x10^{-4}
2	8	31.8	62.5	2.0	1.18 x10^{-4}	1.19x10^{-4}
2	4	63.5	250.	4.0	0.666x10^{-4}	0.69x10^{-4}
2	2	127.0	500.	2.0	0.404x10^{-4}	0.42x10^{-4}

Space Factor

The foregoing formula will serve for most ordinary cases where the space factor, defined as the ratio of the copper area to the product of the length times the winding depth, is above 35 per cent. For lower values a correction factor needs to be applied which is 1.01



CURVES GIVING RATIOS OF MEAN RADIUS AND WINDING DEPTH TO LENGTH

for a space factor of 1/3, 1.04 for ¼, 1.08 for 1/5, 1.12 for 1/6, 1.21 for ⅛, 1.28 for 1/10, 1.47 for 1/15, and 1.62 for 1/20. To illustrate the application of this point, the inductance of a current-limiting reactance, described in the *Electrical World* for Dec. 21, 1912, page 1333, was calculated. The constants of the coil are: $N = 34$, $a = 42.6$, $\frac{a}{l} = 0.58$, $\frac{c}{l} = 0.36$, space factor = 21 per cent. The calculated value of the inductance was 5.54×10^{-4}, compared with 5.83×10^{-4}, the measured value.

Discussion

In explanation of the derivation of curves A and B, it is to be noted that the A curve corresponds to the assumption of a current sheet of radius a and length

[1] *Bulletin* of the Bureau of Standards, Vol. 8, No. 1.

[2] *Bulletin* 53 of the University of Illinois.

*References: (1) *Transactions* N. E. L. A., 1909, Vol. II, page 144, "Current-Limiting Reactances"; (2) *Bulletin* 53, University of Illinois, Brooks and Turner; (3) *Wied. Annalen*, 1905, page 763, B. Strasser; (4) *Physical Review*, Vol. XXIV, page 153, G. W. Pierce, "Wireless Coil."

In Vol. 8, No. 1, of the *Bulletin* of the Bureau of Standards, this curve has been calculated for a range of $\frac{a}{l}$ from $\frac{1}{10}$ to 2, while in the accompanying curve sheet the range has been extended from $\frac{1}{100}$ to 1000. Similarly, the B curve, which was obtainable from this same *Bulletin* in the range of $\frac{c}{l}$ from $\frac{1}{30}$ to 1, has been extended in range from $\frac{1}{100}$ to 100. These extensions of the above curves have made the formula universal and rendered it possible to include the solution of the inductance of any air-cored solenoid on one page, as shown on the curve sheet.

Alternating-Current Electromagnets

BY CHARLES R. UNDERHILL

The laws of the static pull due to alternating-current electromagnets can be shown to be identical with those for direct-current electromagnets by taking the mean effective pull and making allowances for core losses. Since the power component of the pressure or voltage is directly proportional to the total effective current, there is a proportionality between the total alternating-current ampere-turns and the direct-current ampere-turns required to produce the same pull under similar conditions. The same principle applies to the active volt-turns.

If there were no core losses the alternating current would be of the same value as the direct current, for the same active voltage and pull, not instantaneously but effectively, because the static pull is due to the flux in either case. No mechanical work is performed by the electromagnet in either case, and the same flux which produces the pull also generates the emf of self-induction in the case of alternating current. Therefore, the writer believes that the ampere-turns of direct current which will produce a certain pull with an alternating-current electromagnet represent the true value of effective alternating-current ampere-turns which will be required to produce the same mean effective pull as with direct current.

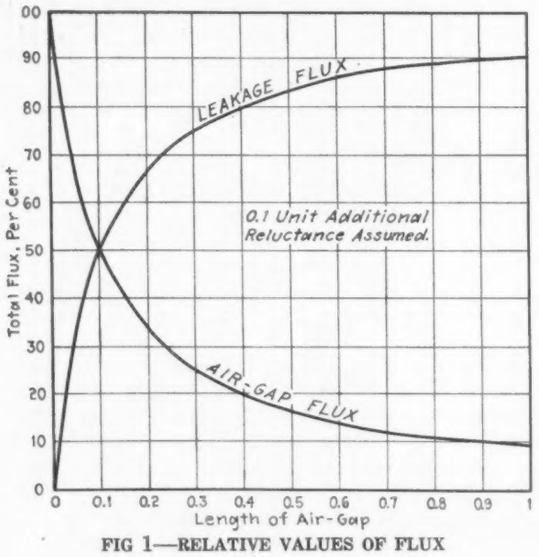


FIG 1—RELATIVE VALUES OF FLUX

In the tests to be described a spring balance was used for measuring the pull. A spacer was inserted between the plunger and the stop to represent an air-gap. When the spring of the balance was extended in measuring the pull, the pointer showed very little evidence of vibration, and since the mass of the spring was very small, as compared with the mass of the plunger, and the vibration of the plunger was slightly damped by friction, it would seem that a mean effective pull was being obtained. A brief résumé of the general laws of electromagnets will here be given. The plunger type with stop and frame is selected.

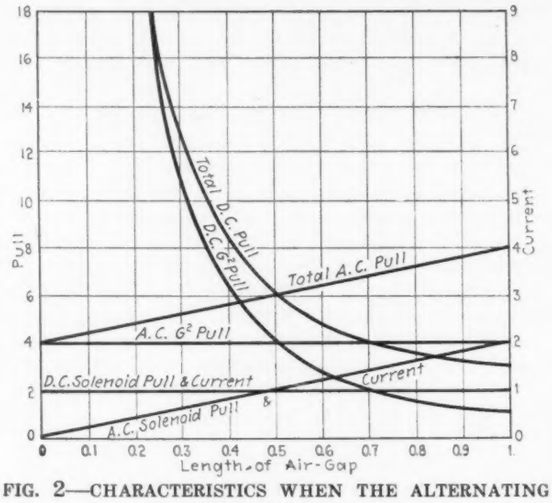


FIG. 2—CHARACTERISTICS WHEN THE ALTERNATING CURRENT FALLS TO ZERO

After eliminating all constants, the law of Maxwell for the pull between the plunger and stop at the middle of the coil, when there is no air-gap, is

$$P = B^2 \qquad (1)$$

In this it is assumed that the coil is also divided at the point of division of the core. But

$$B = 4\pi I + H \qquad (2)$$

Allowing G to represent $4\pi I$

$$B = G + H \qquad (3)$$

and

$$P = B^2 = G^2 + 2GH + H^2 \qquad (4)$$

Conventionally stated, G^2 is the pull between the plunger and the stop; $2GH$ is the pull between the coil and plunger and coil and stop; H^2 is the pull between the two half-coils and is not available in the practical type. Therefore, the law for the pull between the flat-faced plunger and stop, when they are in perfect magnectic contact and there is no leakage from the abutting ends back to the frame or their opposite ends, is

$$P = G^2 + 2GH. \qquad (5)$$

Now as soon as the plunger and stop are separated and an air-gap is introduced, these conditions are changed, because a new factor is introduced, namely, the leakage of the flux from the inner ends of the plunger and the stop back to their opposite ends, which causes them to become much more highly magnetized than if the flux passed only through the air-gap. This leakage flux is exceedingly important in alternating-current magnets, especially, and grave errors result when it is not considered. The stop is assumed to be fixed in position and cannot move, but its reluctance will be higher than if the flux were confined to the air-gap. This leakage effect is so great that a strong pull is obtained between the plunger and coil even when there is no other iron present.

The pull due to a plunger electromagnet with an air-gap becomes, therefore,

$$P = G^2 + 2GH + 2G_1H, \qquad (6)$$

wherein G is the flux density in the air-gap, $(B_a - H)$, and G_1 is the density $(B_i - H)$ of the leakage flux in the plunger. There are now two active magnetic

circuits in shunt with one another instead of only one circuit, as when the air-gap was completely closed. Therefore, $G^2 + 2GH$ is the total air-gap pull and $2G_1H$ is the leakage pull.

Generally speaking, the leakage pull is a maximum when the length of the air-gap is maximum, but when the length of the air-gap of a plunger electromagnet is

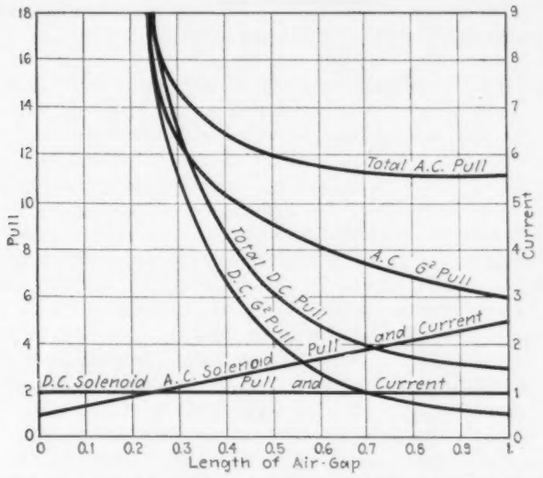


FIG. 3—CHARACTERISTICS WHEN THE ALTERNATING CURRENT DOES NOT FALL TO ZERO

reduced to zero there can be no leakage whatsoever, and the law of the total pull is then expressed by equation (5). On the other hand, the air-gap flux will vary inversely as the length of the air-gap, so that the general conditions, for a direct-current plunger electromagnet, so far as the air-gap and leakage fluxes are concerned, are graphically represented in Fig. 1. It is to be observed that the sum of the two fluxes is assumed to be of constant value, to illustrate the general principle.

It will now be readily seen that Maxwell's law is true for a closed air-gap, under the ideal conditions previously mentioned, but that it does not hold for tractive electromagnets unless modified to allow for the extra pull due to leakage.

Perhaps the relations may be better understood by writing equation (6) in the form

$$P = G^2 + 2H(G + G_1). \qquad (7)$$

Since G is proportional to the part of the flux from the plunger which passes through the air-gap and G_1 is proportional to that part of the flux which does not

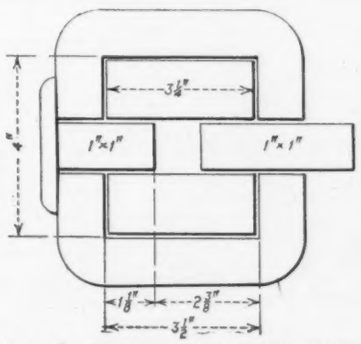


FIG. 4—TESTING ELECTROMAGNET

pass through the air-gap, it is evident that the total pull between the coil and the plunger, which may be called the "solenoid pull," will be $2H(G + G_1)$, and the pull due to the contraction of the flux in the air-gap, proportional to $B_a - H$, is simply G^2. This will be called the "G^2 pull." The total pull is the sum of these two pulls.

Fig. 2 shows the theoretical conditions with the air-gap in that part of a plunger electromagnet where the magnetizing force due to continuous current is assumed to be of constant value. It is also assumed that there is no reluctance in the plunger, stop and frame, and that there are no hysteresis or eddy-current losses, so that the alternating current will fall to zero when the plunger is in perfect magnetic contact with the stop. The G^2 pull, varying as $\frac{i^2}{l^2}$, wherein i is the direct-current value of the alternating current and l is the length of the air-gap, will be of constant value for all lengths of air-gap, and the total alternating-current pull will be the sum of the G^2 and solenoid pulls.

The direct-current G^2 pull will, however, be in the form of a hyperbola, while the total direct-current pull will be equal to the sum of the solenoid and G^2 pulls.

In Fig. 3 are shown the same characteristics for direct current as in Fig. 2. The alternating current and consequent alternating-current solenoid pull do not fall to zero in this case. A comparison of the alternating-current characteristics in Figs. 2 and 3 shows that in the latter case the total pull is not only greatly increased at the beginning of the stroke but that it increases as the air-gap diminishes, somewhat after

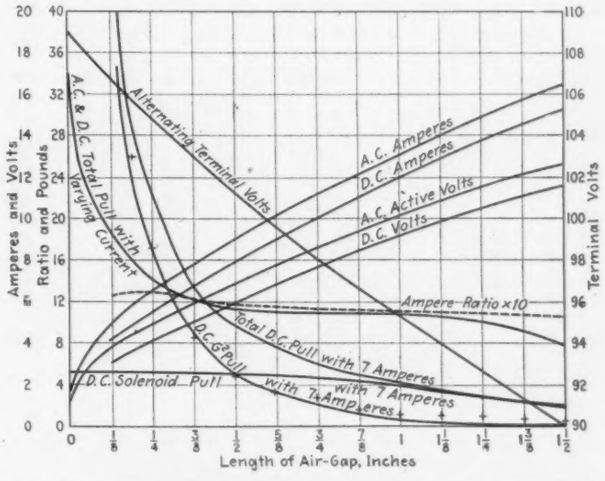


FIG. 5—TEST CHARACTERISTICS WITH BOTH ALTERNATING AND DIRECT CURRENT

the manner of the direct-current pull. Practical alternating-current electromagnets have losses due to reluctance, hysteresis and eddy currents, and the alternating-current solenoid pull does not fall to zero.

In Fig. 4 are shown the general form and dimensions of a standard alternating-current plunger electromagnet which was kindly loaned to the writer by a well-known manufacturing company. Fig. 5 shows the general characteristics. Tests were first made with alternating current to determine the pull and current for various lengths of air-gap. Energy for testing the electromagnet was taken from a sixty-cycle lighting circuit and, consequently, there was a considerable drop in the line. Next tests were made with direct currents of such values that the pull was the same for direct current as with alternating current. The stop was then removed and the solenoid pull found for all points, through the former air-gap, with direct current. A test was also made with direct current, with the stop in place, in order to find the total direct-current pull. In Fig. 6 are shown the characteristics obtained by first calculating the solenoid pull for alternating current from the direct-current solenoid pull data. The alternating-current G^2 pull is found by subtracting the alternating-

current solenoid pull from the total alternating-current pull.

Now the G^2 pull is proportional to $\frac{i^2}{l^2}$. By allowing an additional reluctance for the ferric parts corresponding to one-sixteenth unit of length of air-gap and dividing by 30 to bring the $\frac{i^2}{l^2}$ values to the same scale as the G^2 pull values in both Figs. 5 and 6, and using the direct-current values, the calculated G^2 pulls coincide favorably with the actual G^2 pull curves, as indicated by the crosses which represent the calculated points. By using different lengths of stops, pull curves of various forms are obtained. The solenoid pull, due to the varying values of the magnetizing force for constant direct-current value of ampere-turns, at different positions inside the coil, is the cause. The use of shading coils, to prevent chattering, in no wise affects the principles above outlined.

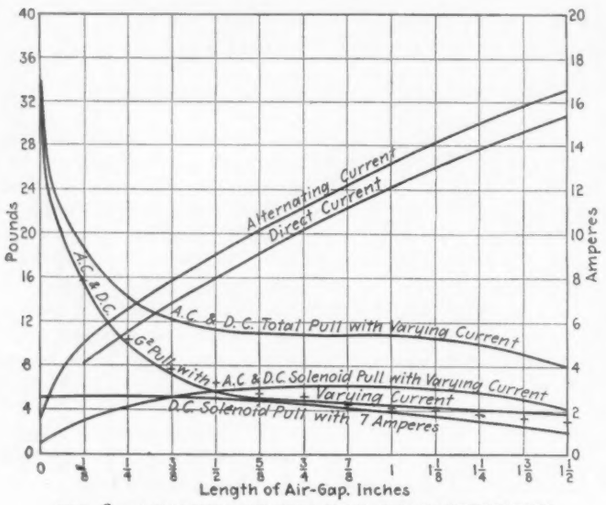

Pounds
Amperes
Alternating Current
Direct Current
A.C. & D.C. G² Pull
A.C. & D.C. Total Pull with Varying Current
G² Pull with A.C. & D.C. Solenoid Pull with Varying Current
D.C. Solenoid Pull with 7 Amperes
Length of Air-Gap, Inches

FIG. 6—ANALYSIS OF THE TEST CHARACTERISTICS

Recent Improvements in the Metropolitan Plant at Kansas City, Mo.

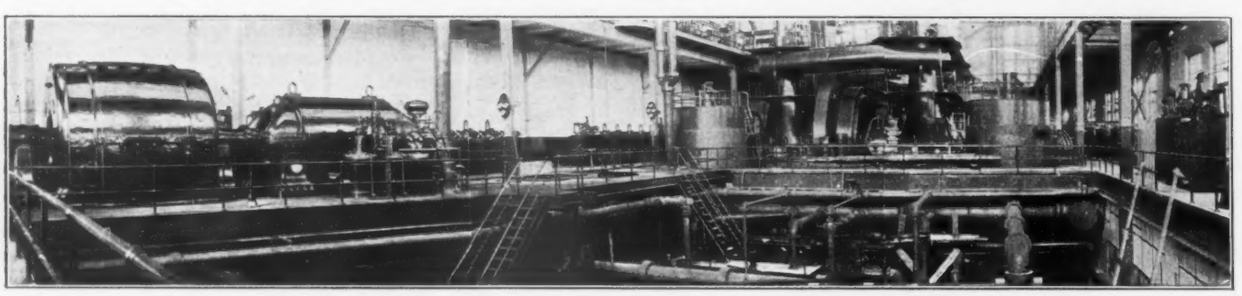
With the rapid extension of transmission and distribution lines and with additional loads coming on the existing city railway and lighting feeders of the Kansas City Railway & Light Company, additional generating equipment in the station has been found necessary. Within the last year a second 15,000-kw turbine has been installed, replacing a vertical turbine unit of 5000-kw rating, so that now the main generating equipment of the station consists of two vertical General Electric 15,000-kw, 6600-volt, twenty-five-cycle, three-phase turbines; one horizontal Westinghouse 7000-kw, 6600-volt, twenty-five-cycle, three-phase turbine, and two vertical reciprocating engines driving 6600-volt, twenty-five-cycle, three-phase alternators, all direct-connected. This equipment is operated on a single set of buses, and, owing to the fact that all equipment can be connected in parallel, the station power-factor ranges near 98 per cent continuously. Protection for the 15,000-kw units against heavy short-circuits on the twenty-five-cycle mains near the station is to be provided by two sets of reactors now being installed between the station bus and the terminals of the machines.

Recently two banks of three single-phase 6600/33,000-volt transformers were installed on the third gallery of the station to step up the voltage for transmission to Cement City and way points. To insure continuity of service the transmission lines serving these customers have been erected in duplicate and a double equipment of lightning arresters and switches has been placed in the station. At Cement City, 12 miles distant from the plant, a single customer is served. This patron is a cement-mill owner with an installation of 3000 kw in motors. Some of these units operate throughout the entire twenty-four hours of the day. This plant is the company's largest motor-service customer. According to the contract under which the motors in this mill are operated, the load curve of the cement mill is adjusted to vary inversely with that of the electric-service company's generating plant, an arrangement which, of course, conduces greatly to economy of operation.

The control of the mill's load curve to avoid heavy demands during the system's peak is accomplished by having grinding operations and other heavy work performed early in the day and keeping these motors off the line from 5 p. m. till 7 p. m. Among the other customers served along the route of this 33,000-volt line are the Kansas City Nut & Bolt Works and the American Radiator Company, each operating installations ranging from 500 hp to 1000 hp.

New York's Oldest Private Plant

The oldest private electric generating plant in New York City, according to Mr. C. M. Ripley in a paper presented before the recent meeting of the Society of Heating and Ventilating Engineers, is the installation of Edison dynamos driven by "Safety Steam" engines in the Mills Building opposite the Stock Exchange on Broad Street. This plant, which is still in daily operation, was installed in 1883, only four years after Edison's invention of the incandescent electric lamp. The three 25-kw Edison generators have been in continuous daily service for thirty-one years, although the plant has since been supplemented by the addition of a 75-kw, a 100-kw and a 160-kw unit made necessary by the increased demand for artificial illumination in the Mills Building as the height of surrounding structures has increased.



PLANT OF KANSAS CITY (MO.) RAILWAY & LIGHT COMPANY

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Electric Trucks in Central-Station Service at Atlanta, Ga.

For the last three years the Georgia Railway & Power Company, Atlanta, Ga., has had in service a 750-lb. electric wagon, which during that time has completed a total travel of over 30,000 miles, 25,000 miles of which was made on a single battery. There was one renewal of tires, and with the exception of the second battery the only repairs amounted to one hub cap and one chain.

In its gas-installation division the same company has another 1000-lb. General Vehicle wagon which made 16,500 miles in three years. The repairs for a period of more than two years ran less than $400. Another 2-ton truck in service two years has made 10,000 miles and is still using the original battery.

Central-Station Service Practically Universal in Denver

Ten years ago several isolated plants were operating in Denver, Col., but since then the Denver Gas & Electric Company has made central-station service so attractive that most of these private installations have been discarded and the company's service has been adopted in their place. Not a private plant has been installed in the last three years, and only three have been erected in the last ten years.

The automobile-assembling factory recently erected at Denver by the Ford Motor Company will likewise use central-station energy. All of the vehicles for the company's Rocky Mountain trade will be assembled in this factory, which is a four-story reinforced-concrete building. About 200 hp in motors is installed, and the total monthly energy consumption will be about 30,000 kw-hr.

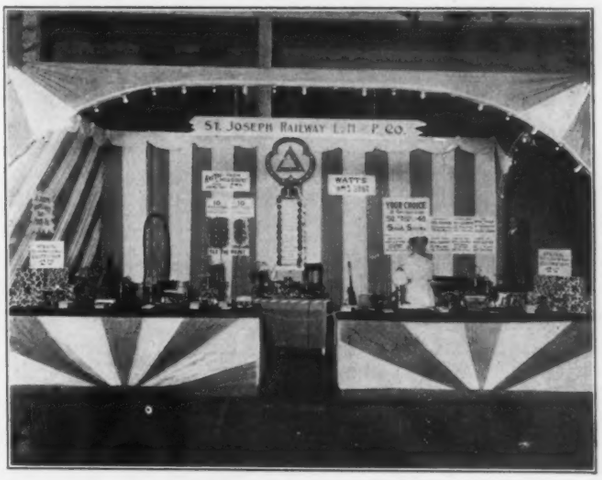
Remarkable Expansion of Electric and Gas Service in San Diego

San Diego, Cal., is increasing rapidly in population, but the expansion of the public-utility interests has proceeded at even a greater rate. The city's inhabitants in 1910 numbered not quite 40,000. While it is difficult to estimate the population to-day, the local authorities agree that the figure is in the neighborhood of 80,000. In 1905, when the San Diego Consolidated Gas & Electric Company came under the management of H. M. Byllesby & Company, the city had an estimated population of 25,000. Since 1905, however, the gas and electric distributing systems have been extended to suburbs and adjacent towns, and the population served with gas is now estimated as about 95,000, although the population served electrically is not quite so large. The electric output of the company named for the year previous to the advent of the Byllesby management was 1,166,817 kw-hr. For the calendar year 1913 the kilowatt-hour output was 14,404,741, an increase of 1130 per cent, while the population served increased less than 400 per cent. Between April 1, 1905, and Jan. 1, 1914, the rating of the company's electric generators increased from 1220 kw to 8470 kw. There is now one electricity meter to every 5.6 of population, as compared with one to every 20.9 in May, 1905. The number of customers of the electric department of the company increased from 1181 to 17,054 and the total connected load from 1128 kw to 28,384 kw, the increase here being 2410 per cent. The increase in number of customers in the gas department was 870 per cent, comparing May, 1905, with November, 1913.

Teaching Customers the Cost

To demonstrate to users of electricity in St. Joseph, Mo., the low cost of operating electric household devices, the St. Joseph Railway, Light, Heat & Power Company made good use of an electric sign flasher in its booth at the recent "Fos Festival" exhibit. Connected to the flasher were a number of household appliances, including a flatiron, electric heater, chafing-dish, hot-water cups, a sewing machine, luminous radiator, coffee percolator, fan, electric samovar, disk stove, washing machine, tailor's iron, curling iron, warming pad, vacuum cleaner, and groups of carbon and tungsten lamps.

The flasher switched these devices successively into circuit, at the same time lighting a pilot lamp on a central board, opposite the name of the device in service at the moment. A wattmeter connected in circuit with the appliances had its scale specially graduated to read in cents per hour the cost of operating each device, so



CENTRAL-STATION BOOTH AT ST. JOSEPH'S "FOS FESTIVAL"

that the spectator who lingered in front of the display for a few minutes had an automatic demonstration of the expense of running the various appliances scattered throughout the booth. The attractively fitted-up display room and the flashing of the colored pilot lamps made the company's booth one of the most popular during the auditorium exhibit.

Loading Sand Electrically Along the Mississippi

On the Mississippi River at Davenport, Ia., barges ply between the sandbanks in the river and the spur tracks of the railroad which reach down to the waterfront conveying to the cars for shipment sand that accumulates in times of high water. To save time in loading the sand from the barges onto the cars the motor-driven belt conveyor shown in the accompanying illustration has been erected. Sand unloaded from the boats is dumped into a pit at the lower end of the runway, where it is picked up by the concave belt and carried to the chute above the cars. The belt travels at approximately 80 ft. per minute, the power being supplied by a 7.5-hp, 440-volt, two-phase motor operated from the circuits of the People's Light Company. It is stated that the time and money saved over the old method in which the sand had to be shoveled out of the barges into wagons and then up into the cars repays many times the cost of energy for driving the motor.

MOTOR-DRIVEN SAND LOADER

Welfare Work in St. Louis

Mr. A. C. Einstein, general manager of the United Electric Light & Power Company, of St. Louis, has announced that the company plans to establish a welfare club during the present year. The building at Vandeventer Avenue and Morgan Street is to be transformed into an employees' club house, equipped with bowling alleys, gymnasium, billiard and pool tables, library, etc. A separate gymnasium and quarters in the club are planned for the women employees of the company. Possible additional features are a ballroom and a swimming pool. The membership in the welfare club will be restricted to employees of the company, who will be divided into two classes, major and minor. Major members must be twenty-one years old, and their dues shall be proportionate to salaries earned, ranging from $3 a year for those whose salaries are under $50 a month to $12 a year for those whose salaries exceed $150 a month. The annual dues of the minor members and women shall be $3. From the annual dues an allowance of 25 per cent shall accrue to those members of the welfare club who are also members in good standing of either the Employees' Mutual Benefit Association or the Union Electric Light & Power Company Section of the National Electric Light Association. Those who are members of both of these associations shall be entitled to apply 50 per cent of their club dues toward the dues of those societies.

Mr. Einstein also announced that the company has under consideration the establishment of a pension plan by which employees who have reached a certain age and have been in continuous service with the company or its predecessors for a period of years may be retired with a life pension. In committing itself to this pension system the company will reserve certain privileges, which will be set forth fully in the rules and regulations now being compiled. The company is active in welfare work, maintaining or assisting a mutual benefit association among employees, a company section of the N. E. L. A., a loan fund, an orchestra and a glee club, as well as a free educational course for salesmen.

Small Versus Large Quantity Purchases of Electrical Supplies

The central-station manager in the small city or town is often in a quandary as to the quantities in which he should purchase his supplies. The large-quantity discounts are alluring, but, on the other hand, he does not want to tie up money in slow-moving stock. The governing feature, of course, should be the return on the increased investment. If one has not given more than the usual amount of thought to the subject, the additional discounts for large purchases are likely to cause him to underestimate the actual return on the increased investment.

As a concrete example, consider the purchase of sockets by a company using, say, 1000 sockets per year. The present list price on these is 33 cents, with discounts of "50 and 15" for 500 lots, and "50, 15 and 10" for 1000 lots. At first glance this might appear to be a return of only 10 per cent on the additional money invested when the larger quantity is purchased, and as there may be other uses for money where the return will be greater, the manager is very likely to buy the sockets in 500 lots twice each year. A little calculation, however, will show the return to be much greater if 1000-lot purchases are made each year.

With all discounts considered the problem works out as follows, assuming that in one case 1000 sockets are purchased at the beginning of the year and that in another instance 500 sockets are bought at the beginning of the year and six months later another 500 lot is purchased:

1000 sockets	$126.13	
Interest, one year, at 6 per cent	7.56	
Total		$133.69
First purchase, 500 sockets	$70.12	
Interest, one year, at 6 per cent	4.20	
		$74.32
Second purchase, 500 sockets	$70.12	
Interest, six months, at 6 per cent	2.10	
		72.22
Total		$146.54

The purchaser therefore actually saves $12.85. The difference between the interest on the two investments at 6 per cent is $7.56 less $6.30, or $1.26. If $1.26 is the difference in interest at 6 per cent on the two investments, then one may think of the $12.85 saved as representing 66 per cent return on the increased investment necessary to purchase and carry the larger quantity.

Some plants are so small that they may not require 1000 sockets in several years, and in such cases it may be best to purchase in smaller quantities notwithstanding the results obtained by the other method. The managers of these may claim that small-quantity purchases are best for them. There are, however, very few plants that do not use 250 rosettes in the course of two years, yet many managers of such plants prefer to buy these and other standard supplies in one-fifth standard packages.

One example will show the fallacy of this plan. As-

sume rosettes listed at 26 cents each, with 40 per cent discount in one-fifth package lots, or 60 per cent discount in standard packages of 250 pieces. This problem may be worked out in the same manner as the socket transaction, assuming that in one instance the standard package is purchased at the beginning of the two-year period, and that in the other purchases of one-fifth standard packages are made at the beginning of this period and at intervals of four and four-fifth months thereafter. The results show an ultimate saving of $10.53 at the end of the two years, an amount which many in the same way be viewed as 132 per cent on the excess investment.

A few hours spent with a standard supply catalog and discount sheet in working out similar problems will doubtless convince any follower of the small-quantity purchasing method that he has been losing money in a manner almost as mysterious as a magician's tricks.

Electric Motors in a Modern Warehouse

An aggregate of 350 hp is usel for motor drive in the new warehouses of Park & Tilford, West Forty-

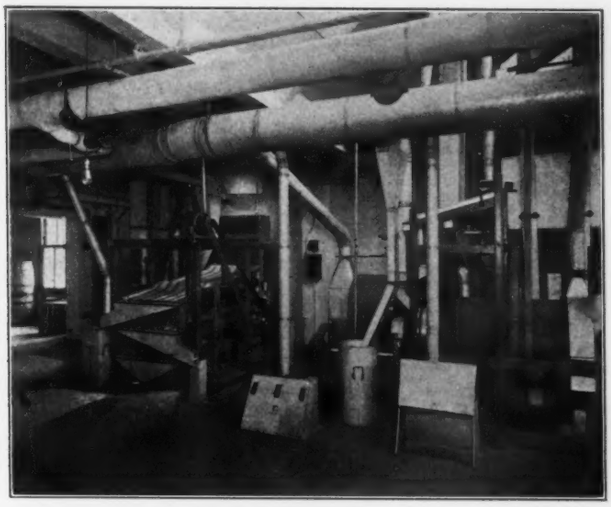


FIG. 1—GREEN-COFFEE MIXER, MILLING MACHINE AND SEPARATOR

second and Forty-third Streets, New York. Of this total rating, 175 hp is used for driving one passenger and six freight elevators, each of the latter having a capacity of 4500 lb.

Of the several departments into which the building is divided, that devoted to the preparation of coffee is perhaps the most completely equipped. The coffee, which arrives in the bean, passes from one to another of the various machines through strong galvanized-iron chutes. Six roasters are operated by shaft drive, power being obtained from a 7.5-hp motor. Separate motor drive is used for each of three grinders, a pulverizer, a mixer for roasted coffee, a green-coffee mixer, a green-coffee cleaner and a green-coffee separator. A 50-in. Stuyvesant suction fan, operating at 1500 r.p.m. and driven by a 15-hp motor, cools the product as it emerges from the roasters. Another fan disposes of the smoke that rises from the coffee during the roasting process.

The work done in the spice rooms consists chiefly of grinding and sifting. Two large grinders, driven by 20-hp motors, are used in the preparation of the pepper and ginger, and a pulverizer working at 2775 r.p.m. takes care of the cinnamon, cloves and allspice. Nutmegs are broken up by a motor-driven cracker. The spices are sifted by means of electrically operated machines. Of the latter one device of new design distributes both the product and the waste automatically into their proper receptacles. Sifters of a somewhat older type, having bucket-shaped receptacles with bottoms of fine silk, are also employed.

In the liquor and wine vaults are several electrically

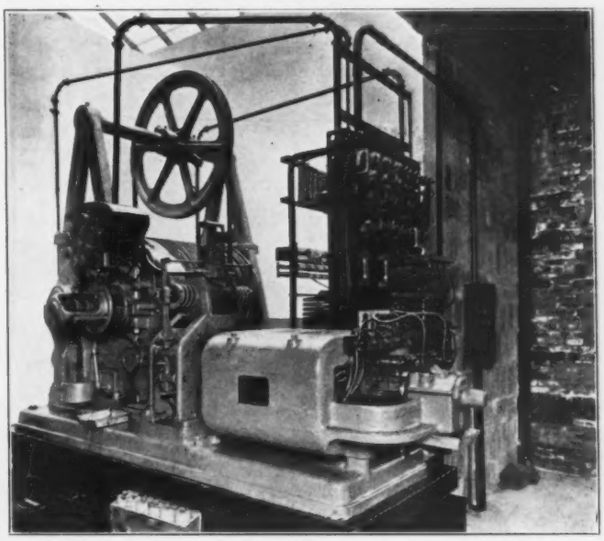


FIG. 2—PASSENGER-ELEVATOR MOTOR

driven appliances. Among these is a bottle-corking machine to which the bottles are conveyed from the automatic fillers. The corking machine can be adjusted to handle various sizes of bottles. Long bottle-washing sinks are equipped with self-adjusting rubber-coated instruments which are inserted into bottles and revolved rapidly while a stream of water delivered at a pressure of 60 lb. per sq. in. circulates about them. Two elec-

FIG. 3—BOTTLE-CORKING MACHINE

tric disk stoves or hot plates heat the wax which is used to seal the liquor flasks.

The principal rooms in which cigars are handled are ventilated by means of pipes radiating from an electrically operated humidor. Air is forced through a veil of running water into these pipes by a 3.5-hp fan.

The pumping equipment is in the basement and con-

sists of three house pumps and a sump pump, each driven by a 7.5-hp motor, a well pump and a small boiler pump. The sump pump handles 400 gal. per minute. The building is supplied from an artesian well 325 ft. deep. An ice machine, in the basement, is operated by a 12-hp motor.

One of the main features of the building is a thoroughfare and driveway, 83 ft. wide, running from Forty-second to Forty-third Street, and containing 14,000 sq. ft. of space, which enables thirty-six trucks to load or unload at the same time. The driveway is equipped with charging posts for electric vehicles, twenty-six of which can be charged here at one time.

The lighting installation of these warehouses aggregates the equivalent of 4000 16-cp lamps.

Proposed Street-Lighting Contract for Milwaukee

The City Club of Milwaukee recently appointed a committee to investigate the question of street lighting for that city, which has been before the public for some time. This committee has made recommendations to the Common Council which gives evidence of considerable thought on the part of the members of the committee and an appreciation of some of the economic and technical problems involved in street-lighting contracts. The committee points out that there is considerable difference of opinion among citizens of Milwaukee at present as to the desirability of the city installing and operating a municipal lighting plant. It finds, however, that citizens appreciate that present conditions of inadequate street lighting are well-nigh intolerable and that Milwaukee is paying tens of thousands of dollars in commercial and economic losses annually. The committee believes it is practicable to arrange at once for the installation of an adequate street-lighting system without prejudicing either favorably or unfavorably any action which the city may wish to take in the future in the matter of a municipal lighting plant.

The first question discussed is whether a contract for street lighting should be signed at this time with a private company. The report shows that in view of the differences of opinion as to the advisability of installing a municipal plant it would be unreasonable to assume that Milwaukee would be in a position to obtain energy for street lighting from a municipal plant in less than three years, and probably it would be four or five years. It is unthinkable, the committee says, that the present grossly inadequate street lighting should be endured for from three to five years longer. On the other hand, no new lamps, even of the present inefficient type, can be obtained or expected under the present no-contract condition with the central-station company. The committee thinks the city should enter into a contract with a private company for lighting the streets under the rather unusual terms which are given later.

The usual form of street-lighting contract is on the lamp-year basis, under which the city pays a fixed sum per year for each lamp installed. This is seriously objected to by the committee. At least 60 per cent of the cost to a private company in furnishing street lighting is the interest and depreciation on the investment. These figures apply to a ten-year contract. For shorter contracts the interest and depreciation factor represents a still larger proportion of the total. The signing of such a contract usually finds a city with a more or less inadequate street-lighting system. Generally a new contract provides for the adoption of an improved type of street lamp. Upon the signing of such a contract the lighting company proceeds to install a very large number of the new type of lamp. It is to the interest of the lighting company to furnish just as much street lighting as the city is willing to authorize and to have the lamps installed at once so as to receive interest and depreciation on the investment throughout the entire period of the contract. At the end of the first year or two of such a contract a considerable investment in new lamps has been made. By this time it generally happens that there have been improvements in street lamps and the existing type is no longer the most satisfactory. Nevertheless, it is not to the interest of the lighting company to make a change, because such change would open anew for discussion the question of rates and cost, or the adoption of a new and more satisfactory type of lamps might tend to create a demand for investment in new distributing circuits of lamps before the investment in old circuit lamps had been covered by the interest and depreciation charges.

The lamp-year basis of contract, therefore, involves an unwisely large investment in one type of lamp during the earlier period of the contract and an unwisely small investment in any type of lamp during the later years of the contract. Moreover, the lamp-year basis of contract involves such practical difficulties in making any change in the type of lamp that such changes are very unlikely to be made. The lighting company naturally and properly figures so that it will be repaid during the contract term for its investment in lamps. At the end of the contract the city is in the position of having paid for the lamps without having any title to them.

No such difficulties exist in the case of private lighting contracts. A department store for example purchasing electric service owns its own lamps, reflectors, fixtures and motors. As improved lamps, etc., are placed on the market the store brings its equipment up to date. It purchases energy on the kilowatt-hour basis. At the end of any contract it owns the lamps for which it has paid.

If the kilowatt-hour basis were used for the city's street-lighting contract, it would involve the ownership by the city of the wires, lamps and lamp-poles devoted to street lighting only. There would be no incentive to install a large number during the early period of a contract and an insufficient number during the latter period. The question of financing such a purchase would discourage the city from making an excessive purchase of lamps at one time. This would be a desirable result in view of the improvements that are constantly being made in street lamps. As improved lamps were introduced self-interest would not stand in the way of the city promptly availing itself of them. The city would pay the actual cost of the lamps only and would then own them instead of paying twice over, as happens with the lamp-year contract when the same lamps are employed for two different contract purposes.

To carry out the last-mentioned contract it is suggested that the present street lamps in Milwaukee be rented from the Milwaukee Electric Railway & Light Company on a per month basis. The city would then devote a certain amount to the purchase of new lamps each year to replace the antiquated lamps.

The city is not organized at present to assume properly and economically the responsibility for the purchase, installation and maintenance of lamps and poles under such a contract. A proper organization could be made, but a simpler plan is recommended, that the city pay for the purchase, installation and maintenance of the street lamps by the lighting company, the city paying the actual cost of labor and material plus a percentage to cover the overhead expense; the final power to specify type of equipment rests with the city.

The city would pay for its street lighting month by month on the kilowatt-hour basis, and for installing lamps and for maintenance like private consumers.

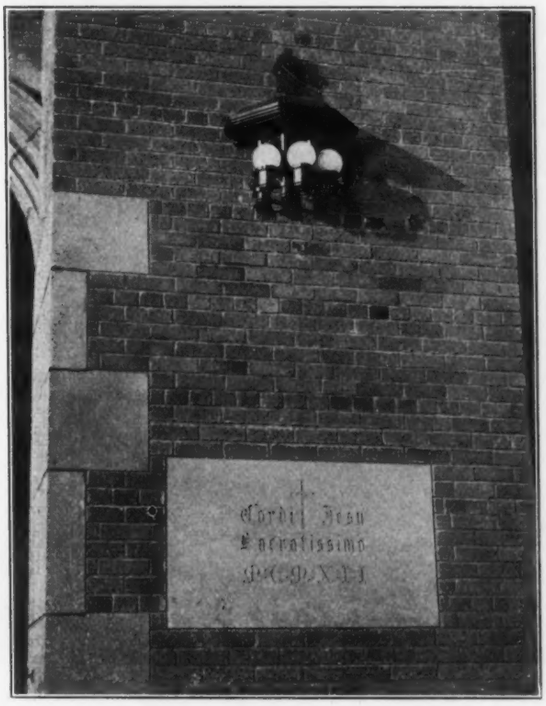
Illumination and Wiring

Improving "Island of Safety" Lamps

Accidents have happened by reason of the elevated "islands of safety" in city streets not being clearly visible either because the red signal lamp failed to burn or because of exceptional darkness during the period when the lamp is unlighted. The islands of safety, with their red lamps, have been placed in Minneapolis streets recently to the number of about a dozen. The Minneapolis General Electric Company furnishes the electricity for the 60-watt tungsten lamps in the red globes. But Mr. R. F. Pack, the general manager of the company, thought there should be some protection besides the large lamp. So he had his construction men connect a tiny 2-cp lamp in the main lamp circuit. This lamp is placed in the big red globe beside the principal lamp. It is, however, wired to the supply circuit at a point beyond the switch controlling the 60-watt lamp, this switch being operated by a watchman. The little lamp is thus burning constantly, and it affords enough light to make the red globe dimly visible in the dusk or dark should the main lamp for any reason be unlighted. This added "safety first" precaution has been introduced by the company entirely at its own expense.

Attractive Entrance Lighting for Church

The architectural possibilities of modern exterior electric lighting for church entrances are illustrated in the halftone accompanying this note, the view having been taken at the recently completed Church of the

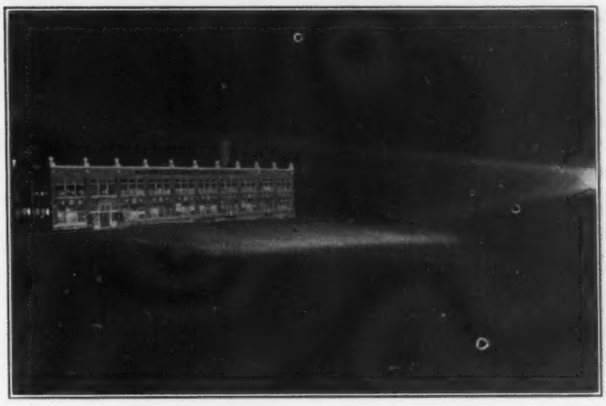


ORNAMENTAL LIGHTING FOR CHURCH

Sacred Heart in Watertown, Mass. On each side of the main entrance and 7.5 ft. above the steps is located an ornamental copper bracket with semi-hexagonal hood covering the tops of three 5-in. ground glass globes held in place on cup-shaped bases by the usual fixture screws. Each globe carries a 25-watt, 110-volt tungsten lamp, the lamps being set 8 in. apart on centers. The lighting effect secured is dignified and the fixtures and canopies are thoroughly ecclesiastical in appearance without losing practical usefulness in illuminating the steps. Energy is supplied from the local central-station lines.

Searchlamp Illumination of Building Front

The Philadelphia plant of the Hess-Bright Manufacturing Company is situated near the main-line tracks of



BUILDING FRONT LIGHTED FROM SEARCHLAMP

the Pennsylvania Railroad, and advantage has been taken of this fact to attract the attention of passengers on night trains by illuminating the entire front of the office building by a projector lamp concealed from view.

Mounted on a 25-ft. steel tower at a distance of 250 ft. in front of the building wall is a 50-amp, 10,000-cp, 24-in. searchlamp using 110-volt direct current. The building front itself is 200 ft. long and 34 ft. high, and after nightfall, as shown in the illustration, it is bathed in an intense illumination which one observer describes as "sunlight at night." The searchlamp consumes 5.5 kw-hr. per hour and costs about 27 cents per hour to operate. It is used from five to six hours nightly. Installed complete, this spectacular lighting scheme cost about $1,000.

Complying with Wisconsin's Voltage-Regulation Law

For the past three months Mr. C. R. Phenicie, general superintendent of the Green Bay (Wis.) Gas & Electric Company, has been making a study of the voltage conditions existing on the feeder circuits of his company, in order to determine the changes necessary to comply with the voltage-regulation order recently issued by the Wisconsin Railroad Commission. The rule specifies that the voltage on all circuits shall be regulated within 3 per cent of the normal potential.

To the small utility, where the common practice of the operators has been to boost the station voltage at times of peak load in order to compensate for the line drop, compliance with the ruling often means a large expenditure from which the company derives no direct revenue. Mr. Phenicie, after three months' study, declares that some form of induction regulator seems to be the only device which will control his standard 75-amp feeders satisfactorily.

The subject of voltage regulation was brought up for discussion at the January meeting of the Wisconsin Electrical Association, following a paper by Mr. G. G. Post, of the Milwaukee Electric Railway & Light Company, as reported on page 193 of last week's *Electrical World*.

Street Lighting from Private Plant in Hospital

The private electric-service and heating plant of the Kansas City (Mo.) General Hospital is equipped with three 150-hp Erie City water-tube boilers supplying steam to reciprocating engines which drive two Westinghouse 110-volt generators rated at 100 hp and 75 hp respectively. Since at no time does the electrical load of the hospital demand the full output of the machines the authorities of the institution have combined forces with the local health and park boards to light the hospital grounds and part of Gilham Road leading from the new union depot. To avoid the need for excessive copper conductors two 20-kw motor-generator sets were installed, which raise the potential from 110 volts to 220 volts. At the latter pressure the energy is conducted through underground wiring to the eighty lighting standards, all of which are of the type shown in Fig. 1.

FIG. 1—LIGHTING UNITS ON HOSPITAL GROUNDS

One-hundred-watt tungsten lamps are used in all units, the eighty lamps being connected on six circuits. The small switches for controlling these circuits are shown at the base of the panelboards (Fig. 2). Motor-generator and switchboard equipments have been installed in duplicate, either machine having sufficient rating to supply the eighty lamps. As compared with the gas lighting formerly used there and still used on the neighboring streets, the new installation, declares Mr. John M. Coughlin, chief engineer of the hospital, is a marked improvement. Mr. A. R. Winnie is chief electrician for the plant.

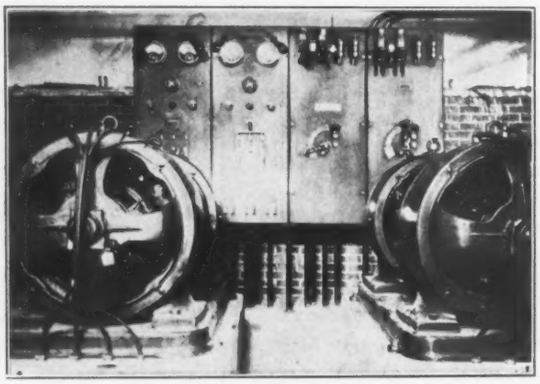


FIG. 2—MOTOR-GENERATOR SETS IN KANSAS CITY GENERAL HOSPITAL

Carrying Out the Color Scheme

When the ground floor of an old building at Milwaukee, Wis., was remodeled recently the exterior lighting units were included in the general scheme of improvement. As will be seen from the illustration, the fronts of the new store were finished in white tile, and to aid in extending the air of cleanliness to the exterior the entire installation of ornamental posts was painted pure white with the exception of their bases, to which a coat of bronze was given.

ORNAMENTAL STANDARDS PAINTED WHITE

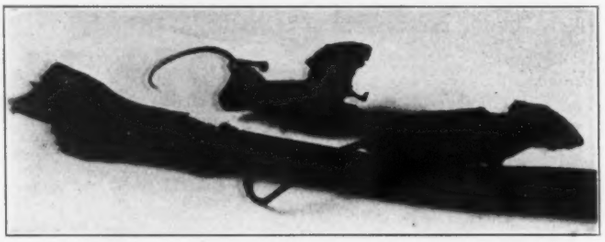
The posts are thus attractive in appearance both by night and by day and have created much favorable comment on the neatness of their appearance and the way they harmonize with the white store fronts.

Cable Burn-Out Caused by Mice

BY J. J. SKELLY

An interruption occurred recently in a 2200-volt feeder supplying energy for the operation of a railroad signal system.

The oil switch on the circuit opened on a short-circuit and when restored tripped out again. Smoke was noticed issuing from an iron conduit carrying the feeder and a test showed that the feeder was grounded therein.



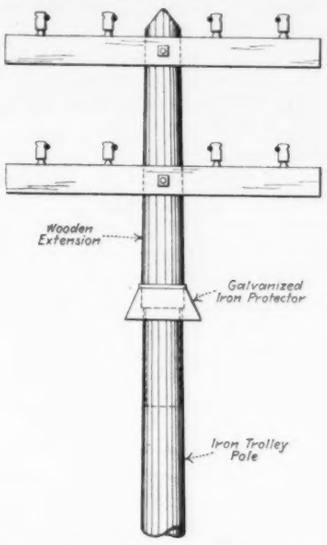
BURN-OUT IN 2200-VOLT CABLE, AND CHARRED BODIES OF MICE

The cable when pulled out revealed the charred bodies of two mice at the point where the cable broke down. They had evidently gnawed into the insulation, causing a short-circuit when the wire was reached.

After pulling in new cable and re-establishing service the ends of the conduit were sealed with a mixture of plaster of paris and mineral wool, with a view to the avoidance of any further trouble of the kind.

Protecting Wooden Trolley-Pole Extensions

In Kansas City, Mo., as in many other places, it has been found convenient to add wooden extensions to the tops of iron trolley poles for the purpose of suspending overhead feeders. Usually such construction is considered more or less temporary, but as is the case with much temporary construction, it has a way of remaining in service until necessity forces a change. Here, however, an effort has been made to provide something more than a piece of temporary construction, so that galvanized-iron rain shields have been provided for the joint of the wood and the iron pole. Just as the wooden



PROTECTOR FOR JOINT OF WOODEN-POLE EXTENSION

pole fails at the ground line, so the extensions when placed as shown in the accompanying sketch weaken first at the top of the iron pole. When the poles are carrying several heavy trolley feeders and lighting circuits even a very little rot is likely to produce a dangerous condition in case a bending strain is imposed. Hence the precaution of protecting as far as practicable against the entrance of moisture from the pole joint reduces liability of failure.

Recent Telephone Patents

Two different methods of designing call-distributing systems of telephone apparatus were recently made the subjects of patents. In one of these, granted to Mr. S. H. Brown, of Pittsburgh, Pa., the signal-control switches are associated with the individual lines. When a call is made on any line the distributing switch belonging to that line hunts out an idle set of line-lamp and answering-line contacts, and thereby extends the calling line to an idle exchange operator. The usual jack multiple is placed before this operator. The answering lines end in plugs and cords, and each is provided with a listening key. A disconnecting signal is also provided for each trunk for signaling the operator to clear the line called. The calling line is automatically cleared by the restoration of the selecting switch when the receiver at the calling station is hung up.

The other system is described in a patent granted jointly to Messrs. H. J. W. Fay, of Westboro, Mass., and E. C. Molina, of East Orange, N. J. In this system the selecting switches for distributing the calls are associated primarily with the operators' positions. The subscribers' lines are grouped in proper lots and each group has access to a selective switch upon a sufficient number of different operators' positions. In this system a call from any one of a group is picked up by the first idle switch of that group and signaled to the corresponding operator. By properly arranging the sequence of switches and signals for various groups the calls are evenly distributed. Both these patents are assigned to the American Telephone & Telegraph Company.

Letters to the Editors

Electric Trucks for Parcel Post Service

To the Editors of the Electrical World:

SIRS: On page 1345 of your issue of Dec. 27 appears an article entitled "Electric Trucks for Parcel Post Service," in which comparison is made between the performance of gasoline cars and electric vehicles, and it is stated that as a result of the data shown the use of gasoline cars was discontinued in parcel-post deliveries at Indianapolis.

The data indicate that the cost per parcel-mile with the gasoline cars was 25 per cent higher than with the electric vehicles, but examination of the figures shows that the gasoline cars made far longer runs, with fewer stops and fewer parcels. They were thus used in their proper place, that is, outside the radius of operation of the electric trucks, so that the comparisons made are not by any means based upon identical conditions.

Had the gasoline trucks been operating on the same service as the electric trucks, the difference in favor of the latter would probably have been much greater than the 25 per cent shown. On the other hand, had the electric trucks been operating on the same service as the "gas" cars, the latter would probably have made a far better showing.

J. V. ROCKWELL,
Bureau of Yards and Docks, Navy Department.
Washington, D. C.

"Combined Synchronous and Induction Motor Loads"

To the Editors of the Electrical World:

SIRS:—Readers of the discussion on "Combined Synchronous and Induction Motor Loads," by Mr. H. L. Wallau, in the *Electrical World* for Nov. 22, 1913, will doubtless find further facts of interest reported in an article of mine in your issue of Feb. 3, 1912, entitled "Comparison of Commercial Economy of Gas Engines and Steam Turbines." In this article the topic enlarged upon by Mr. Wallau was discussed in a general way. In the steel works mentioned in my article a new electric mofor-driven merchant mill had been projected, and the matter of all-alternating-current drive or mixed alternating-current and direct-current drive was under discussion. The project was a big one, requiring an addition to the power station, and, anticipating that the effect of low power-factor would be important, I made estimates on the entire arrangement with both types of drive. The comparison resulted in favor of the mixed drive. The saving in investment and in operating cost effected by the mixed drive using alternating-current and direct-current synchronous motor-generator sets to correct the power-factor more than balanced the loss from the smaller efficiency of the motor-generator sets

compared with transformers. This case was, of course, special, but there are likely many others that would show a similar result.

In the same steel works it had been the custom to correct for "lagging power-factor" with synchronous motors under load, the load carried usually being from 75 per cent to 80 per cent of normal with the motor field set to give about 95 per cent "leading power-factor" at normal load on the motor. Where direct current was to be supplied, synchronous motor-generators were used in the substations. Wherever large motors were to be used and the load conditions would justify it, synchronous motors were put in. The transformer stations were separate, but in each case they were fed with energy from the same line as a motor-generator substation. Correction of the power-factor at the generating station was all that was attempted, however.

The induction-motor load was usually about two-thirds the synchronous-motor load, and the electric-furnace load was about double the synchronous-motor load. With the induction-motor load alone the station power-factor would be from 65 per cent to 70 per cent; with the addition of the electric furnace it would go up to from 75 per cent to 80 per cent; with the further addition of the synchonous-motor load, the power-factor would rise to 92 per cent or 93 per cent, and when the electric furnace was dropped it reached approximately unity.

Hudson, Ohio. FRANKLIN M. FARWELL.

An Alliance for Learning

To the Editors of the Electrical World:

SIRS:—Every friend of technical education will rejoice at the recent announcement that the engineering faculties of the Massachusetts Institute of Technology and Harvard University are to get together in a close union for the advancement of learning and on terms which indicate effectual work for their common end. When a few years ago a merger of the institutions was planned and all but carried through, the project was of a kind which aroused serious and well-grounded opposition among the alumni of both institutions. From the viewpoint of the outsider it involved, on the one hand, the wiping out of the identity and spirit of the country's first technological school, and, on the other, the attempted assimilation of a student body and ideals absolutely foreign to the old leisurely Harvard of the humanities. Educationally, it would have meant an irritating struggle between the new and the old, and, socially, civil war.

The plan of action to-day is radically different, far richer in promise of good, and infinitely broader in spirit, springing from mutual interest instead of mere passion for impressive amalgamation. In brief, the engineering faculties of the two institutions are to join hands and resources, working together under the hospitable roof of the new "Tech," now being equipped on a scale to command the respect of even the most blatant materialist who ever mistook brick and concrete for scholarship. But, though the president of the Institute of Technology is to guide the whole and the bursar of the Institute is to handle the funds, the two high contracting parties retain their individual rights and identities, give their own degrees and guide the courses that lead to them. Each professor who comes over from Harvard holds his chair and title, although *ex officio* holding rank in "Tech," and likewise every "Tech" professor in engineering becomes *ex officio* attached to the staff of Harvard. Thus, howsoever the courses of instruction may be worked out, they can readily be made *de jure* and *de facto* interchangeable as leading to a degree from either institution. Just how these mutual interrelations can be worked out to the best advantage remains to be seen. There will be many complications requiring the wisdom of the serpent to untangle. For it must be remembered that from the engineering standpoint the two institutions have had courses of instruction far from parallel, so far, indeed, that they are difficult to set into equivalency. All the regular engineering work in "Tech" is essentially undergraduate, while much of that in Harvard is essentially post-graduate, although not more advanced in fact, owing to the different requirements for the undergraduate degree. To express the matter with frankness, the Technology course, by ruthless cutting out of non-essentials, by stern enforcement of a defined regimen of study, and by a rigor of persistent instruction that smacks of slave-driving or the finest efforts of the efficiency engineer, has jammed into four years as much of engineering as would ordinarily go into an undergraduate course in science plus a couple of years of post-graduate work. The Harvard engineering courses take these extra two years and start from an entirely less strenuous beginning. How these two different lines of action can be harmonized is no easy matter to predict, but one can easily see that two student bodies of which one is trying to compress into four years about what the other is finishing comfortably in six may not be distinguished by mutual sympathy. It is earnestly to be hoped that things will so turn out that the courses may be made parallel, for it would be better for both if a compromise could be arranged. The outsider can perhaps realize the situation better than those upon whom it has grown by almost imperceptible degrees. The fact is that the "Tech" work has grown to a point of intensiveness which to a certain extent defeats its own ends. Year by year hours and courses have been added at the instance of one department or another, loath to yield one jot or tittle of its influence, until the student is loaded with requirements that he must fulfil superficially or not at all. He is stuffed like a Strassburg goose, with facts forced upon him through tubes leading from divers departments, each jealous lest he escape with too little of its particular sort of pabulum.

When the new alliance is put in force it is devoutly to be hoped that a neutral ground may be discovered on which both institutions may meet for the adjustment of requirements—a calm and peaceful spot where the insatiate desire to have every student specialize in everything may be laid aside in favor of giving him time to think about something. The soothing aid of a curriculum arranged along more leisurely lines should bring balm to the harassed and weary. On the other hand, the party of the second part may not suffer from a little high pressure in the educational engine.

Seriously, the proposed alliance ought not only to conserve energy and better utilize equipment, but it should end in the working out of incomparably the finest technological school in the world. The two faculties now to be united are both strong and can be made even stronger in co-operation. It would have been lamentable to have two schools in the same city trying to compete when they should be helping each other. United, there should be sufficient endowment and instructing force to build up beyond the present a post-graduate engineering course such as neither institution has yet been able to compass, the one from lack of students, the other from too many. And this may furnish the solution of the main problem in technical education—how to put a quart into a pint bottle—by providing a place for the spill-over.

Boston, Mass. BARRETT LEE.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Causes of Transmission-Line Interruptions

Communities depending upon energy transmitted from a distance oftentimes suffer from interrupted service due to no fault at the generating station nor in the substation or local distribution system. The fault is in the high-voltage transmission system, which, however excellently built, is subject to mishaps over which the company has no control. The wonder is that transmission lines traversing open or wooded country for more than 100 miles are not subject to more mishaps than actually occur. Human beings have an unbounded respect for transmission lines carrying high potentials, and to this may be attributed the rapidly decreasing number of service interruptions due to persons with mischievous intentions. However, no one has yet evolved a system which is proof against birds of the air and the smaller animals that can climb with agility.

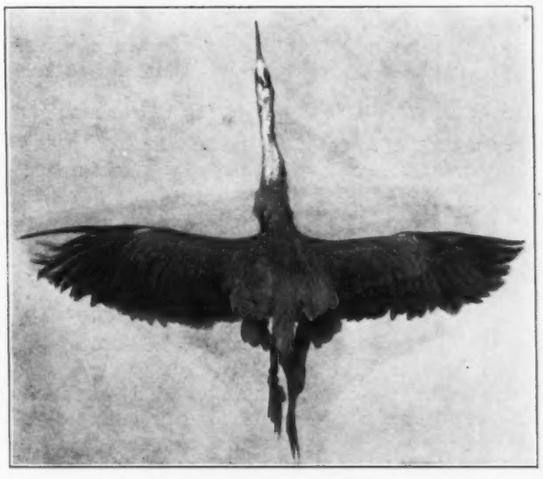


FIG. 1—CRANE THAT GROUNDED 104,000-VOLT LINE

Almost any transmission company can furnish instances of outages due to birds or animals, and four causes for interrupted service in different parts of the country are illustrated herewith.

Fig. 1 shows the crane that grounded the 104,000-volt line of the Sierra & San Francisco Power Company not very long ago. The crane alighted on a tower near the San Joaquin River. It measured 6 ft. 2 in. across from wing to wing.

Fig. 2 shows a small screech owl which placed itself between a grounded pin and a No. 4 three-strand high-tension line carrying 35,000 volts on the system of the Indiana General Service Company between Elwood and Alexandria, Ind. It will be noted that the left wing is badly burned and also the left leg.

Fig. 3 shows a heron which recently caused the electric lighting and railway service of the British Columbia Electric Railways Company, Ltd., Vancouver, B. C., to go out of commission. The heron was flying over the peninsula between the Fraser River and False Creek one night and came in contact with the three high-tension wires of the company along the line of the Lulu Island railway. A short-circuit resulted, about a foot of each of the three wires at the point being burned away. The resulting surge put the substation supplying energy for Vancouver out of business. The cause of the short-circuit was not known until the following morning when the linemen discovered the dead heron lying at the side of the track. The company made good

FIG. 2—SCREECH OWL THAT CAUSED TROUBLE ON 35,000-VOLT LINE

use of the dead bird from a publicity point of view. It was roughly mounted and displayed in the window of a newspaper office on the principal street of the city with a placard hanging from its bill on which was printed, "Why the Lights Went Out Last Night." This exhibit was seen by thousands during the afternoon and evening, the burned leg and body of the bird telling at a glance the cause of the interruption of the company's street-car system, and thereby showing without further explanation the difficulties of the company in maintaining uninterrupted service over a large territory. Pic-

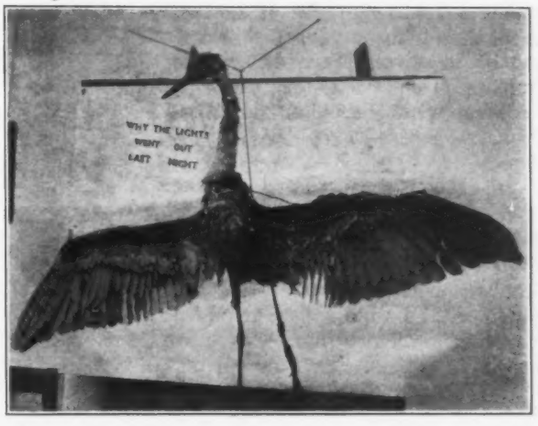


FIG. 3—HERON THAT PUT LINE OUT OF SERVICE IN BRITISH COLUMBIA

tures of the bird were also printed in the daily newspapers of Vancouver, accompanied by explanations of the accident.

Fig. 4 shows the picture of a squirrel which short-circuited and rendered useless a 2000-kw transmission line of the Public Service Company of St. Cloud, Minn. This company has a sixty-cycle, 16,500-volt line which

is 26 miles long and supplies five substations. About 2 o'clock one afternoon the circuit-breaker was thrown out and the switchboard attendant expected to hear that one of the substations had trouble. No complaint was received, but during the night the circuit-breaker was thrown open again. The next day the linemen were sent over the line and found a dead squirrel at the bottom of one of the poles. By that time the circuit-breaker would not stay in at all, and it was of course necessary to look for a punctured insulator. This was found two miles from the spot where the linemen picked up the squirrel. Upon an examination the insulator was found to be punctured through to the thimble which in turn went to the ground. The company employs the "wishbone" type of construction, every other pole being thoroughly grounded to an overhead ground wire. It will be noted that the squirrel's hip was quite badly punctured also and that his ears and whiskers were burned off.

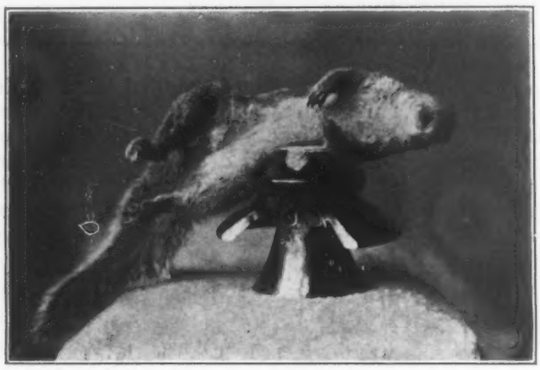


FIG. 4—SQUIRREL THAT CAUSED TROUBLE ON A 16,500-VOLT LINE

Combustion of Oil Fuel

By R. T. Strohm

The efficiency of combustion of oil fuel is dependent upon the furnace in which the burning takes place. The burner should give a finely atomized spray of oil, but the furnace must be of such size and shape as to enable the oil to be vaporized, mixed with the required quantity of air and burned to carbon dioxide before the resulting products of combustion are allowed to come in contact with the boiler surfaces.

Size of Furnace Required

The effect of too small a furnace is to cause incomplete combustion. The oil is sprayed into the furnace in the form of minute globules, each of which must be converted into vapor before it can burn. The heat required for this vaporization is derived from the highly heated firebrick with which the furnace is lined. Each globule of oil, on being converted into vapor, expands to many times its original volume, and this sudden increase of the volume of the oil makes it necessary to have a furnace that will accommodate the expansion. When the furnace is too small the expansion at the moment of vaporization increases the volume so greatly that the gases must travel very rapidly, and the result is that they pass out and come in contact with the boiler tubes or surfaces before the air has been thoroughly mixed with them and before combustion is complete.

The burner also affects the furnace efficiency; for the greater the size of the oil globules the longer will be the time required to convert them into vapor. Their expansion produces a pressure in the furnace, and this pressure, aided by the steam blast, quickly drives them on into the boiler passages. As a result, only the smallest globules are vaporized and burned in the furnace and the others are carried into the boiler passages, where their temperature is lowered and they are only partly burned. Even the carbon dioxide formed by combustion in the furnace may be converted to monoxide by taking up carbon from the unburned gases beyond the furnace.

If there is a very large percentage of carbon monoxide in the gases, secondary combustion may occur; that is, the monoxide may burn on its way through the passages of the boiler, or even in the uptake or the chimney. Although some heat may thus be recovered, the combustion takes place under poor conditions and is not nearly so efficient as when it takes place in the furnace. So, whether secondary combustion occurs or not, heat is lost.

The final effect of too small a furnace, therefore, is to give too rapid a travel of the gases through the furnace, with the subsequent formation of carbon monoxide and waste of heat. For these reasons the oil should be broken up into a spray almost too fine to be seen, and the furnace should have sufficient volume to allow combustion to be completed before the gases leave it. In this way the maximum temperature will be obtained and the loss due to carbon monoxide will be obviated.

Slight Excess of Air Desirable

The amount of air required for the complete combustion of a pound of oil fuel of known composition may be calculated approximately by the formula

$$W = 11.6\,C + 34.8\,H$$

in which

W = pounds of air per pound of oil;
C = percentage of carbon, expressed decimally;
H = percentage of hydrogen, expressed decimally.

For example, suppose that a certain grade of crude oil is found to contain 85 per cent of carbon and 12 per cent of hydrogen. The least amount of air that will burn a pound of this oil completely is

$W = 11.6 \times 0.85 + 34.8 \times 0.12 = 14$ lb., very nearly.

Slight differences in the relative amounts of carbon and hydrogen in oils, together with the presence of such elements as oxygen, nitrogen and sulphur, will cause the minimum amount of air per pound of oil to be greater or less than that just calculated; but with the oils ordinarily used as fuels in steam-boiler work, from 13 lb. to 14 lb. of air would be required per pound of oil if the combustion were ideal and complete.

Just as in the combustion of coal, so in the combustion of oil fuel it is necessary to admit an excess of air to the furnace. The reason is the same, namely, to insure a sufficient supply of oxygen to enable each particle of combustible matter to be burned completely. But there is a great difference between the excess required for solid fuel and that required for liquid fuel. The average coal-burning furnace seldom uses less than one and one-half times the minimum amount of air required for complete combustion, and usually it requires twice the amount or even more; that is, the excess of air ordinarily ranges from 50 per cent to 100 per cent and frequently exceeds the latter value. With oil fuel, the excess of air may be kept as low as 10 per cent by efficient furnace arrangement and careful regulation, and it is not uncommon to find oil-burning plants in which the excess of air is not over 20 per cent.

The reason for the smaller supply of air required lies in the fact that the conditions in the oil-burning furnace are much more favorable to the thorough mixing of the air and the fuel than is the case in a coal-burning furnace. The oil is sprayed, and the air is ad-

mitted in such a way as to mingle intimately and uniformly with it. In the case of coal the air must pass up through the fuel bed, which is of varying thickness, with the result that the resistance is highest and the flow least where the supply should be greatest; that is, at the thickest part of the bed. The use of a small excess of air conduces to greater boiler efficiency because it results in a higher temperature of the products of combustion. For the heat generated is contained in a much smaller weight of gases than in the case of a coal fire.

Causes of Smoke and Soot

The formation of soot or smoke is due to the presence of unburned carbon in the gases, and it may occur even when a sufficient amount of air is being admitted to the furnace. The point to be observed is that the combustible matter shall not only be surrounded with an ample supply of oxygen, but that the temperature of ignition shall be maintained until combustion is complete. In the case of oil fuel the spray is first converted into gaseous hydrocarbons, and these hydrocarbons are broken up into free hydrogen and free carbon. If there is enough oxygen present and the temperature is sufficiently high, the hydrogen will burn to steam and the carbon to carbon dioxide; but if the temperature of the mixed gases is lowered by admitting an excessive amount of cold air, or by allowing the gases to impinge on cold boiler surfaces, combustion will be prevented and the unburned combustible will be carried along with the gases and go to waste.

The free unburned carbon is in the form of fine particles that, on cooling, assume the characteristic black color and appear as smoke or collect as soot on the boiler surfaces. This explains the use of firebrick linings and baffles in furnaces and combustion chambers in which oil is burned. The brickwork becomes incandescent and maintains the temperature necessary to insure the union of the carbon and the oxygen.

Although the condition of the fire in an oil-burning furnace can be judged by observing the flame and noting the roaring sound made by the burners, it is well if the fireman can keep an eye on the gases issuing from the top of the chimney. The smoke, if there is any, should be very light and uniform in color. If it becomes dense, it is a sign that the burners need to be regulated or the air supply readjusted.

Absence of smoke is not necessarily a sign of perfect combustion, and no fireman should assume that he is obtaining the best results in the furnace merely because there is no smoke issuing from the chimney; for the supply of air may be greatly in excess of that required for economy. On this account it is wise to analyze the flue gases, or to install a continuous CO_2 recorder, so that the efficiency of combustion may be under the observation of the management. Particularly is this true of the plant that has been altered from the burning of coal to the burning of oil; for it is found that a fireman accustomed to fire coal is very apt to admit entirely too much air when he takes up the management of oil burners.

Effect of Steam

The idea that the admission of steam to the furnace increases the amount of heat generated is an error that is apparently based on a misunderstanding of the action of the steam during combustion. The steam that enters with the oil is heated to the temperature of the furnace, which is so high that the steam is decomposed, or broken up, into its constituents, hydrogen and oxygen. In the presence of the carbon and oxygen in the gases, however, the hydrogen and oxygen thus liberated are taken into combination again, forming steam and carbon dioxide. Moreover, the amount of heat resulting from the burning of the hydrogen is precisely equal to the amount that was required to set that hydrogen free during the decomposition of the steam. This is directly in compliance with the law of conservation of energy. The net gain, therefore, is nothing, and the final result is the same as though the steam had passed through the furnace without being decomposed. In other words, the steam not only does not add to the heat generated but actually carries away a part of the heat because it escapes to the chimney in a highly superheated condition.

Resistance Grid for Spot Lamp

What size quality and length of wire should be used in a non-adjustable rheostat for a spot lamp operating on a 110-volt alternating-current circuit? The current required is about 25 amp.

J. R. W.

To operate your spot lamp satisfactorily the potential across the carbon electrodes should lie between 45 volts and 60 volts, otherwise the arc will hiss or sputter. Since the lamp is to operate on a 110-volt circuit, the remaining potential drop must occur in the series resistance. Assuming 50 volts as an average drop across the carbon electrodes, the effective resistance required to allow 25 amp to flow must be about 2.4 ohms (disregarding the reactance drop, which is negligible if the resistance coil contains an air core and the turns are separated). Thirteen feet of No. 18 IaIa resistance wire is a good wire to use as it is inexpensive, does not oxidize readily, will not break easily, and has sufficient radiating surface to dissipate the energy absorbed by it. This wire can be wound on an open frame consisting of four insulated, equidistant, parallel spindles fastened between two sheet-metal headers. The spindles should be wrapped with sheet asbestos.

Losses in Metallic Conduits

To distribute energy from a polyphase system we have decided to inclose each conductor in a separate iron conduit. Usually two and even three conductors are run in the same conduit. How do the losses in the conduits compare in these two cases? Are the losses caused by hysteresis or eddy currents or both?

E. R. S.

If all three wires of a three-phase circuit are inclosed in the same conduit and the load on the system is balanced, there is no loss in the conduit, the instantaneous sum of the currents in the three wires being always zero. When only one or two conductors of a three-phase system are inclosed in the same conduit the sum of the currents is no longer zero, and hysteresis and eddy current losses may become large. These losses are caused by the cutting of the conduit by the rapidly expanding and contracting rings of magnetic flux which surround each conductor carrying current. When the conduit is made of iron the density of these concentric rings of flux is increased and the losses in the conduit are correspondingly increased. The drop of potential in single alternating-current wires carrying 50 amp or over, inclosed in iron conduit, may be more than ten times as great as for the same wires carrying direct current, while the rise in temperature may be increased several-fold. Serious trouble may be caused with even lower currents due to temperature rise, voltage drop and energy loss. On the other hand, the losses in brass-coated paper conduits are small. Some experiments conducted recently in this country showed that with a 6.6-amp series circuit operating at 2200 volts there was a drop of only 6.07 volts in 1000 ft. of steel-taped, lead-covered No. 6 cable. Of this drop 2.7 volts was caused by ordinary ohmic resistance.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Ratio, Regulation and Phase-Angle Transformers.—P. S. Agnew and F. B. Silsbee.—A note on an investigation carried out in the Bureau of Standards. A detailed study of all the approximations involved in the derivation of the following formulas for ratio, regulation and phase-angle shows that they are as accurate as are required by the precision with which the quantities involved may be experimentally determined:

N = ratio of turns, primary to secondary.
E_1, E_2 = primary and secondary terminal voltages.
$R = R_1 + N^2R_2$ = equivalent total resistance referred to the primary.
$X = X_1 + N^2X_2$ = equivalent total reactance referred to the primary.
I, I_o = load current and exciting current referred to the primary.
$\cos\theta$ = power-factor of load.
$\cos\gamma$ = power-factor of exciting current.

When $\pm$ signs occur the upper sign should be used for lagging and the lower sign for leading current. A positive phase angle means that the reversed secondary leads the primary.

$$\text{Ratio} = N\left[1 + \frac{IR\cos\theta \pm IX\sin\theta}{NE_2} + \frac{(IR\sin\theta \mp IX\cos\theta)}{2NE_2^2} + \frac{I_oR_1\cos\gamma + I_oX_1\sin\gamma}{NE_2}\right]$$

$$\text{Per cent regulation} = 100\left[\frac{IR\sin\theta \pm IX\cos\theta}{NE_2} + \frac{(IR\sin\theta \mp IX\cos\theta)^2}{2NE_2^2}\right]$$

$$\text{Phase angle} = \frac{1}{E_1}\left[\frac{IR\sin\theta - IX\cos\theta + I_oR_1\sin\gamma}{-I_oX_1\cos\gamma}\right]$$

For most practical work the squared terms in the formulas for ratio and regulation may well be omitted. To test the formula, direct measurements were carried out on two types of lighting transformers by means of the potentiometer method, and covering the whole range of power-factors from zero power-factor, current leading, to zero power-factor, current lagging. The results checked with the values computed by means of the formula from short-circuit and open-circuit data well within the experimental errors.—*Journal Franklin Inst.*, January, 1914.

Commutator Machines.—A note on a recent British patent (No. 29,409, 1912) of A. Heyland. To diminish the emfs induced in the commutation zones of commutator machines for direct-current or alternating-current circuits a portion of all the zones is provided with auxiliary poles or coils, and another portion with recesses, open slots or tunnels, which increases the magnetic reluctance and superposes the effects on those of the remaining commutating poles. As an example, in converters fixed points on an armature winding are connected to one circuit through slip rings and to another circuit through the commutator brushes. The points on the winding from which connection is made are not distributed evenly.—London *Elec. Eng'ing*, Jan. 8, 1914.

Mercury-Vapor Rectifier for Speed Regulation.—F. W. Meyer.—The first part of an article in which the author discusses how recent progress in the construction of mercury-vapor rectifiers may affect the problem of speed regulation of motors. Simplifications are obtained especially for the commutation problem. While for many cases, like traction, it is necessary to investigate how far alternating-current commutator-motors can be advantageously replaced by direct-current motors, there is for many systems with speed regulation a distinct possibility of extending the limits of regulation with the aid of mercury-vapor rectifiers. Simple induction motors can be operated in such a way that with one central rectifier, common to a large number of motors, only one central direct-current commutation is required for the common converter, without commutation for all the motors. The article is to be continued.—*Elek. Zeit.*, Jan. 1, 1914.

Polyphase Synchronous Motors.—A note on a recent British patent (No. 15,523, 1913) of Crompton & Company and H. Burge. To start up and synchronize underload synchronous motors in which the armature has a main alternating-current winding and a small direct-current exciting winding, a distributed closed-circuit winding of the direct-current type is arranged on the field magnet so that it can act as an induction-motor secondary at starting and as a field winding when the machine is up to speed. This is effected by providing two phase tappings, one for the direct-current excitation, which is applied through an adjustable resistance after the motor is run up to speed, and the other for a similar adjustable resistance, which is used at starting.—London *Elec. Eng'ing*, Jan. 8, 1914.

Lamps and Lighting

Combined Neon and Mercury-Vapor Tubes.—A note on a recent British patent (No. 19,439, 1913) of G. Claude. Neon and mercury-vapor tubes are successively lighted and extinguished, so that, owing to the condensation of the mercury vapor by cooling, lights of red, blue and other colors are obtained.—London *Elec. Eng'ing*, Jan. 8, 1914.

Generation, Transmission and Distribution

Bordeaux Transmission System.—An article on the system of the Société d'Eclairage Electrique de Bordeaux et du Midi, which has completed a transmission line of 100 km (60 miles) from its water-power plant to Bordeaux. The water-power plant is located at Tuilière and is rated at 12,000 kw. The company has also two steam stations in the city of Bordeaux, each rated at 3000 kw, while the steam station of the railway company is rated at 2500 kw. The water-power station contains nine 2000-kw, 5500-volt, fifty-cycle, three-phase alternators. There are five transmission lines operating at 13,500 volts and three transmission lines of 50,000 volts.—*Elek. Zeit.*, Jan. 8, 1914.

British Practice in Construction of High-Tension Transmission Lines.—B. Welbourn.—A paper read be-

fore the (British) Institution of Electrical Engineers. The subject of regulations for overhead transmission lines is dealt with first, and the author then describes and discusses the poles used, the method of fixing and spacing conductors, selection of insulators, grounding arrangements, and the subject of telephones and telephone cables used with high-tension lines. He concludes by describing safety devices and the guarding of conductors.—London *Electrician*, Jan. 4, 1914.

Traction

Electrolysis of Gas and Water Pipes.—E. B. ROSA AND BURTON MCCOLLUM.—An account of special studies of electrolysis mitigation with particular reference to the conditions in Springfield, Ohio. The authors first discuss methods of electrolysis mitigation. The three methods applicable to pipes are surface insulation of pipes, use of insulating joints in pipes, and pipe drainage systems (direct taps between pipes and rails, or negative feeders to pipes). The authors next treat of methods to be applied to the railway system. They describe both the uninsulated negative feeder system and the insulated negative feeder system (*a* boosters in separate feeders, *b* insulated negative feeders without boosters, *c* single booster system, *d* inverted booster systems). They then make recommendations for electrolysis mitigation in Springfield, Ohio. Those methods which are intended to be applied to the pipe system are regarded as unsatisfactory in general, and particularly so for conditions as they exist in Springfield. This is the more emphasized by the fact that there are in the pipe systems at Springfield, especially the gas system, a considerable number of insulating joints. So long as these insulated couplings are in place, the application of negative feeders to either the gas pipes or to the water pipes, or to both, would prove disastrous to the gas system in the vicinity of these insulating couplings. On the other hand, if the system of insulated negative feeders be applied to the tracks as recommended in the report so that the potential differences between different parts of the network are reduced to a comparatively low value, the presence of these insulating joints would be decidedly beneficial since they would tend still further to reduce the current flow in the pipes, while the potential gradients would be so small that dangerous potential drops across the insulating joints could not arise. The life and property hazard would also be increased by the installation of a system of feeders connected to the pipes because of the dangers from fires and explosions. The insulated negative feeder system applied to tracks should therefore be adopted as the primary means of electrolysis mitigation in the city of Springfield. It is further recommended that the joints in all the railway systems operating in the city of Springfield be tested at intervals not exceeding six months or a year, and all joints showing resistances exceeding that of 3 ft. of rail should be immediately rebonded so as to maintain perfect continuity of the tracks throughout the city. It is also of very great importance to have the railway tracks of the Ohio Electric Company and the Springfield Railway Company interconnected electrically at all crossings, both for the sake of economy of operation and for the safety of the pipe systems. To neglect this interconnection, or to deliberately insulate the two systems from each other, would invite certain disaster to the underground pipes. The proposed system of insulated track feeders will not only greatly improve voltage conditions throughout the entire negative return, but will also bring about large economies in power which will pay large returns on the small investment required for putting the proposed plan into effect. As compared with the arrangement of insulated track feeders now in service, the proposed arrangement would give considerably smaller drop on the negative return, which in turn would give a higher average voltage on the cars with consequent improvement in the car service and car lighting.—*Technologic Papers*, Bureau of Standards, No. 27, June 19, 1913.

Subway in Christiania, Norway.—A. BRAARUD.—An illustrated article on the new subway in Christiania, Norway, which has a length of 2 km (½ mile) and connects the center of the city with the Holmenkol railroad. Direct current at 600 volts is used, a third-rail being employed in the tunnel and an overhead trolley wire outside of the tunnel.—*Elek. Zeit.*, Jan. 8, 1914.

Installations, Systems and Appliances

Electricity in Mines.—Extracts from the annual reports of the chief inspector of mines of Great Britain, giving data on electric power used in mines, electric accidents, etc.—London *Electrician*, Jan. 2, 1914.

Safety Device for Wet Rooms.—O. HEINISCH.—The author points out the dangers to cattle in electrically equipped stables in the event of grounded conductors. To overcome this danger the Rhenish-Westphalian Electricity Works has developed a safety device which has proved satisfactory in practice. In the case of ground troubles this device disconnects the circuit containing the fault, at the same time short-circuiting it. —*Elek. Zeit.*, Jan. 8, 1914.

Wires, Wiring and Conduits

Wiring Rules.—The new proposed wiring rules of the German Association of Electrical Engineers are printed in the *Elek. Zeit.*, Jan. 8, 1914.

Electrophysics and Magnetism

Principle of Relativity.—KAJURO TAMAKI.—A mathematical paper on the Dobbler principle and the principle of relativity.—*Memoirs* of the College of Science and Engineering, Kyoto Imperial University, Vol. V, No. 6.

Units, Measurements and Instruments

Plugs for Resistance Boxes.—At a recent exhibition of the British Physical Society a new form of resistance-box plug was shown as illustrated in Fig. 1. The usual blocks terminate in vertical portions forming a split cone. These are seen at *b*, *c*, and when the cap is removed these are separated by an air space so that the coil is in circuit. When, however, the cap *h* is pushed into position the pin *k* forces the two half cones apart, the coned cap bringing them into contact with the pin,

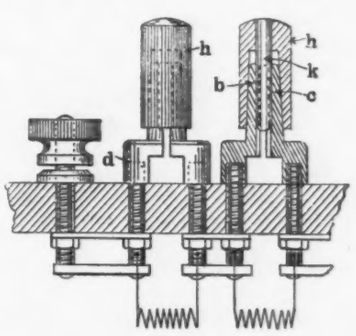


FIG. 1—RESISTANCE-BOX PLUGS

which in itself gives a further contact. The contact resistance is thus reduced to a minimum, even if the surfaces are not very carefully fitted. One great advantage of this method is that each plug is independent of its neighbors (when plugging in or out) as regards constancy of the contact resistance. Thus there is a saving of time in use. The vertical portions are cut

away as shown at the base, so that dust can be easily removed. A resistance box fitted with this type of contact occupies much less space owing to the fact that the brass strips do not require to be so rigid and may, therefore, be shorter; also a larger area of contact per plug is obtained than with the ordinary type.—London *Electrician*, Jan. 9, 1914.

Electro-Dynamic Frequency Meter. — KONRAD GRUHN.—An illustrated description of a new frequency

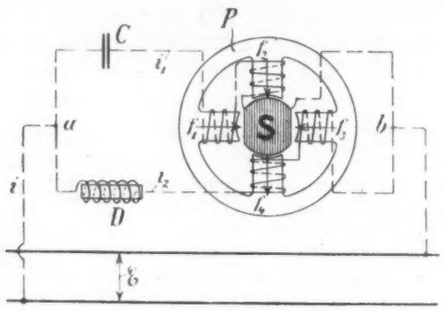


FIG. 2—FREQUENCY METER

meter of Hartmann & Braun. As shown in Fig. 2, four coils f_1, f_2, f_3, f_4 symmetrically arranged produce four alternating fields which are combined in two resulting fields F_1 and F_2 as shown in Fig. 3. In the center there is a movable coil S. Its peculiar form shown in the illustration has been chosen in order to get as uniform a scale as possible. The coils f_1 and f_2 are in series with the condenser C and the movable coil S. The two coils f_3 and f_4 are in series with the inductance coil D. The two coils f_1 and f_3 form together the flux F_1 and the two fluxes f_2 and f_4 form the flux F_2 as shown in Fig. 3. There are, therefore, two branches of the circuit between the points a and b, one branch containing the condenser C and the other the inductance D. The two points a and b are connected to the circuit in which the frequency is to be measured. The author calculates the two electric torques which, while counteracting each other, determine the position of the movable coil S. If the frequency is increased, the current i_1 increases while i_2 decreases and the position of the coil is changed.

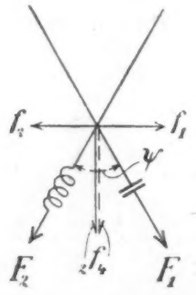


FIG. 3—DIAGRAM SHOWING RESULTING FIELDS

The scale of the instrument is nearly uniform. It consumes about 60 milliamp.—*Elek. Zeit.*, Jan. 8, 1914.

Analysis of Alternating-Current Waves.—FREDERICK W. GROVER.—A long paper on the analysis of alternating-current waves by the method of Fourier with special reference to methods of facilitating the computations. The equations of Fourier for the resolution of a periodic curve into a series of component sine curves, although furnishing a complete solution of the problem, suffer under the disadvantage that, in making numerical calculations, a large number of products have to be formed. Consequently other less satisfactory methods have been employed to shorten the calculation. By grouping similar terms Runge has so simplified the use of the Fourier equations as to greatly reduce the labor of calculation. The object of the present paper is to stimulate a more general employment of Runge's method by the systematic arrangement of the calculations and the use of multiplication tables such as to render inconsiderable the time and labor necessary for the precise analysis of alternating-current curves. The derivation of Fourier's equations for the case of a finite number of odd harmonics is sketched briefly, using the treatment in Byerly's "Fourier's series and spherical harmonics," and this is followed by a development of the simplifications introduced by Runge. The arrangement of the calculation is given in detail for three special cases, namely, for six, twelve and eighteen measured ordinates per half cycle, together with verifying equations which facilitate the location of numerical errors. The considerations which determine the choice of the proper schedule of analysis in any given case are treated at some length. The complete calculation of the amplitude and phases of the component waves of experimentally determined alternating-current curves is carried through, using each of the three schemes of analysis. Further examples are given in connection with what has been previously enunciated with respect to the choice of schedule and to illustrate the accuracy of the results. The latter part of the paper is devoted to the consideration of a few practical applications, such as the calculation of average and effective values, average power, and equations of power curves, together with a full illustration of the principles involved in numerical examples. — *Bulletin* Bureau of Standards, Vol. IX, No. 4, Dec. 15, 1913.

Micropyrometer.—G. K. BURGESS.—An illustrated description of a micropyrometer for the rapid estimation of the melting points of minute specimens as fine as 0.001 mg or less. Within the Huyghens eyepiece of an ordinary microscope a small incandescent lamp is mounted, which is in series with a rheostat and ammeter. The tip of the filament of the lamp is set to the brightness of the platinum strip viewed from above at the instant of melting of the metallic or other specimen on which the microscope is focused. The eye of the observer, therefore, sees the specimen, the platinum strip and the lamp filament all in focus at once, and the current through the lamp is taken as a measure of the temperature of the strip, as in the Morse or Holborn-Kurlbaum pyrometer.—*Bulletin* Bureau of Standards, Vol. IX, No. 4, Dec. 15, 1913.

Meter.—A communication from the Reichanstalt admitting for calibration a direct-current-motor meter of the Siemens-Schuckert Company for two-wire and three-wire systems from 200 amp to 750 amp and for 65 volts to 750 volts. The construction and operation of the meter is described.—*Elek. Zeit.*, Jan. 8, 1914.

Calorimetric Resistance Thermometer.—H. C. DICKINSON AND E. F. MÜLLER.—An illustrated description of an improved form of calorimetric platinum-resistance thermometer. A difference formula for simplifying calorimetric computations is given and its applicability is shown.—*Bulletin* Bureau of Standards, Vol. IX, No. 4, Dec. 15, 1913.

Telegraphy, Telephony and Signals

Duplex Telegraphy.—RICARDO LOPEZ.—An illustrated article in which the author describes the ordinary methods of duplex telegraphy and then describes a new duplex system of his own. Translated in abstract from *Revista Telegrafica* (Buenos Aires) in London *Electrician*, Jan. 9, 1914.

Magnifier.—At the recent exhibition of the British Physical Society there was an exhibit of Huertley's magnifier, for use in cable telegraphy or wireless teleg-

raphy, or wherever it is required to magnify the effect of very small mechanical movements. The principle of the instrument is as follows: Two very fine wires with a high electrical temperature coefficient are mechanically connected to a recorder coil which is acted upon by the incoming current. These wires form the two arms of a Wheatstone bridge circuit, the other two arms being fixed resistances. In place of the galvanometer in the circuit is placed the recording instrument, which, for the present purpose, is the ordinary siphon recorder. This Wheatstone bridge or local circuit is supplied with a current from a local battery which is of sufficient intensity to heat the fine wires considerably above the temperature of the surrounding atmosphere. These wires are so positioned that when there are no signals being received they lie theoretically half in and half out of the blasts of air which blow continuously in a plane at right angles to the plane of movement of the wires. The blasts of air are so positioned relatively to these heated wires that, on these latter being moved in one direction or the other by the incoming current, one is inserted more into its blast of air and the other is inserted less. The physical effect of this relative change of position is that whereas one wire as a whole becomes more cooled owing to a greater part of its length being inserted in the blast, the average temperature of the other wire is increasing owing to the cooling effect of the blast of air being removed from an additional portion of its length. The effect of these changes of temperature on the electrical properties of these wires is that the total resistance of the cooled wire is reduced and that of the other increased. As these two wires are arranged on the adjacent sides of the Wheatstone-bridge local circuit, these changes in the balance are additive. The result is that a current passes through the siphon-recorder coil, reproducing in this coil the movement of the primary coil, but in magnified form, the degree of magnification depending upon the strength of the blast and the intensity of the current passing through the wires. There is a slit along the whole length of each tube of the blowers. This is adjustable in breadth, the position of the slit being so adjusted by moving the tube by means of an adjusting screw that the blast is projected in a vertical direction. These "blowers" are mounted on platforms which enable any required position of the tubes relative to the wires to be obtained. Air is supplied to the blowers from a reservoir by two rubber tubes, and a small electrically driven fan supplies the current of air to the reservoir. The wires used are drawn by the Wollaston method—that is, about 3 mils or 4 mils platinum wire is coated with a shell of silver until the total diameter is between 20 mils and 30 mils. The whole is then drawn down to 3 mils or 4 mils in diameter, which results in the platinum core being of the order of 0.5-mil diameter. The wire is supplied with the silver coating intact and is mounted on the suspension in this condition, the silver coating being finally removed with nitric acid. The magnifier produces an increase of speed on duplex cable working of from 40 per cent to 50 per cent and has been adopted by many of the cable companies and found to work satisfactorily.—London *Electrician*, Jan. 9, 1914.

Portable Wireless-Telegraph Transmitter.—At the recent exhibition of the British Physical Society there was shown a portable Leslie Miller condenser radio-telegraphic transmitter. This apparatus can be worked from a 100-volt or 200-volt continuous-current supply and has a range of about 15 miles. The method of operation is shown in Fig. 4 and employs a high-speed platinum-pointed interrupter, across which is shunted a condenser *C* in series with an inductance, which forms the primary winding of a step-up transformer *T*. The inductance is shunted with a small steadying condenser *c*. The magnet coil *u* of the interrupter also acts as a choking coil, so that on a 100-volt circuit the interrupter can be put straight across the mains. With a 200-volt circuit, however, a non-inductive resistance *R* (about 25 ohms) is inserted in series with the interrupter. The secondary winding of the transformer operates an ordinary oscillation circuit, the only peculi-

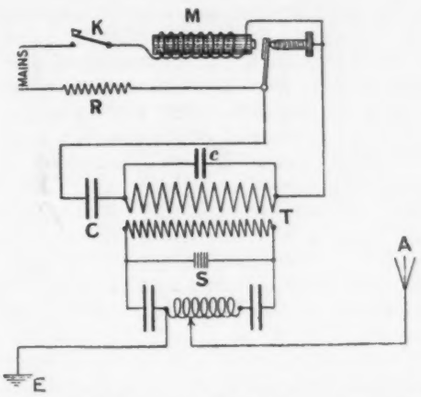


FIG. 4—PORTABLE RADIO-TELEGRAPHIC TRANSMITTER

arity of which is the spark-gap *S*. This consists of four copper plates fixed close together and separated at the ends, which are beveled by small glass tubes. The transmitter takes from 1.5 amp to 2 amp, and very little sparking occurs at the interrupter, owing to the arrangement of the primary circuit.—London *Electrician*, Jan. 9, 1914.

Quenched-Spark Wireless Telephony. — W. T. DITCHAM.—A general description is given of experiments in wireless telephony on a commercial basis between stations situated at Letchworth and Northampton, covering a distance of about 50 km. Satisfactory results have been obtained, and speech has been received up to a distance of 155 km. An alarm apparatus in conjunction with a Brown relay was used with good results in carrying out these experiments.—London *Electrician*, Jan. 1, 1914.

Miscellaneous

Electrolysis in Concrete.—E. B. ROSA, BURTON MCCOLLUM AND O. S. PETERS.—An article giving an account of investigations relating to the nature and causes of the phenomena resulting from the passage of electric current through concrete, with a discussion of the possibilities of trouble from electrolysis in concrete structures under practical conditions. The observations of previous investigators that the passage of current from an iron anode into normal wet concrete caused the destruction of the test specimen by cracking the concrete were only partly confirmed. This effect was found not to occur in most of the specimens tested when the potential gradient was less than about 15 volts through a distance of 3 in., or about 60 volts per foot. These figures must be considered as but roughly approximate, as they depend much on conditions. Of the numerous theories that have been advanced for the cracking of reinforced concrete owing to electric current, that one which attributes it to oxidation of the iron anode following electrolytic corrosion has been fully established. The oxides formed occupy two and one-fifth times as great a volume as the original iron, and the pressure resulting from this increase of volume causes the block to crack open. Corrosion of iron anodes even in wet concrete is very slight at temperatures below about 45 deg. C. (113 deg. Fahr.). The lack of corrosion of the iron at temperatures below 45 deg. C. is due to the

inhibiting effect of $Ca(OH)_2$ and possibly other alkalis in the concrete. The rapid destruction of anode specimens of moist concrete at high voltages (60 volts to 110 volts or more) is made possible mainly by the heating effect of the current, which raises the temperature above the limit mentioned above. Salt, as a small addition to concrete, should never be used in structures that may be subjected to electrolytic action. Reinforced-concrete structures built in contact with sea water, or in salt marshes, are more susceptible to electrolysis troubles than concrete not subjected to such influences. Contrary to the observations of previous investigators, there was a distinct softening of the concrete near the cathode. This begins at the cathode surface and slowly spreads outward, in some cases as far as 0.25 in. or more. After exposure to the air this softened layer becomes very hard again but remains brittle and friable. The softening effect at the cathode noted above under the conditions of the experiments caused practically complete destruction of the bond between the reinforced material and the concrete, reducing the strength of the bond to a few per cent of its normal value. Unlike the anode effect, which becomes serious in normal concrete only at comparatively high voltages, the cathode effect was found to develop at all voltages used in the experiments, the rate being roughly proportional to the voltage in a given specimen. Because of this cathode effect, the proposal to protect reinforced-concrete buildings by maintaining the reinforcing material at cathode polarity as by a battery or booster would be much more dangerous than no protection at all. In order to insure safety or reinforced concrete from electrolysis, the investigation shows that potential gradients must be kept much lower in structures exposed to the action of salt waters, pickling baths and all solutions which tend to destroy the passive state of iron. All direct-current electric-power circuits within the concrete building should be kept free from grounds. If the energy supply comes from a central station, the local sections should be periodically disconnected and tested for grounds and incipient defects in the insulation. In the case of isolated plants ground detectors should be installed and the system kept free from grounds at all times. All pipe lines entering concrete buildings should, if possible, be provided with insulating joints outside the building. If a pipe line passes through a building and continues beyond, one or more insulating joints should be placed on each side of the building. If the potential drop around the isolated section is large—say, 8 volts or 10 volts or more—the isolated portion should be shunted by means of a copper cable. Lead-covered cables entering such buildings should be isolated from the concrete. Wooden or other non-metallic supports which prevent actual contact between the cable and the concrete will give sufficient isolation for this purpose. Such isolation of the lead-covered cable is desirable for the protection of the cable as well as the building. The interconnection of all metallic work within a building is an advantage where practicable, provided that all pipe lines entering the building are equipped with insulating joints and lead cables are taken care of as just indicated, but the grounding of such interconnected metal work or any part of it to ground plates or to pipe lines outside of the insulating joints is in every case to be strictly avoided.—*Technologic Papers*, Bureau of Standards, No. 18, 1913.

Effects of Electricity on Reinforced Concrete.—Kurt Lubowsky.—The conclusion of his article. The author describes laboratory tests on the behavior of reinforced concrete when subjected to direct current or alternating current and states the conclusions at which he arrived. —*Elek. Zeit.*, Jan. 8, 1914.

Book Reviews

Electric Interlocking Handbook. By the engineering staff of the General Railway Signal Company. Rochester, N. Y.: General Railway Signal Company. 435 pages, 283 illus. Price, $3.

As stated in the introduction of the book, the authors aim to "furnish data that will be useful to all those seeking a true understanding of the dynamic indication principle, and to those who are required to prepare bills of material for or to install, operate or maintain our electric interlocking." The book is divided into eighteen sections. The railway signal electric interlocking system as manufactured by the General Railway Signal Company is described in detail and complete instructions for installing and operating the system are given. Several sections are devoted to general data and other valuable information, making the book, as its name indicates, a handbook. It is of the convenient "handbook" size and has flexible covers. The book is clearly written and well illustrated, and the mechanical details have been well executed.

Cost Reports for Executives as a Means of Plant Control. By Benj. A. Franklin. New York: The Engineering Magazine Company. 139 pages; form inserts. Price, $5.

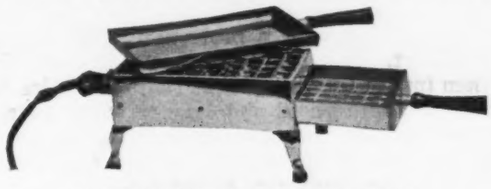
It is indisputable that proper information regarding the cost of production is the most essential aid to the manufacturer. The writer of the above-named treatise has given us an instructive book, in which he has endeavored to treat also the philosophical aspect—or, perhaps better, the common-sense aspect—of cost keeping. He says: "It is a happy feature of the element of expense that once the proper rules of distribution have been decided upon it becomes much simpler to obtain and distribute in costs than the elements of material and direct labor." It is difficult to disagree with the author in regard to this statement, but it is equally difficult to agree with him in regard to the common-sense problem which his statement involves. In his chapter on "Philosophy of Costs" the author has not altogether shed light upon the innumerable pitfalls of cost systems. He states that "a well-operated cost system is a species of insurance. It insures against a continuance of unprofitable policies and the taking of unprofitable orders." The fact is, however, that a cost system does not give out more than is put into it. It is one of the greatest exaggerations of the claims of those who have made capital out of "scientific management" that they have found a nostrum which is applicable to the problems of management and mismanagement of our manufacturing concerns. A good cost system is neither more nor less in the operation of a plant than accurate measuring instruments are in a tool room. It is much easier to obtain the latter than it is to obtain good tool makers who know how to use them; and it is much easier to devise cost methods than it is to know how far to trust to the inflexible figures and how to interpret them, continually keeping in mind their premises and the arbitrary data which constitute the "burdens" or the overhead charges. In solving problems of this kind the book before us should prove of assistance. The book is unlike most treatises on the subject, which are concerned with the headings and rulings of forms and cards and the routine of clerical details. Use is made of forms, but they are viewed from the standpoint of the executive in order to determine what are the vital facts as to material, labor and expense and their relation to one another. The author's discussion is not limited to any one business, but covers principles that can be carried out in various ways.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Grill

The electric grill shown in the accompanying illustration is being put on the market by the Rutenberg Electric Company, Logansport, Ind. The device is



CAST-ALUMINUM ELECTRIC GRILL

made of cast aluminum which is highly polished. It is equipped with two cast-aluminum pans as shown and can be used for broiling, frying, etc.

Vegetable-Paring Machine

The machine illustrated herewith is designed for paring potatoes, turnips, carrots, etc., by means of a friction disk inside a cylindrical hopper. A 1-hp shunt-wound motor, which is rated at 120 volts and operates at 1800 r.p.m., is used to drive the device. The friction disk causes the contents to rotate and come in contact with a "diverter" fastened to the cylinder, which forces

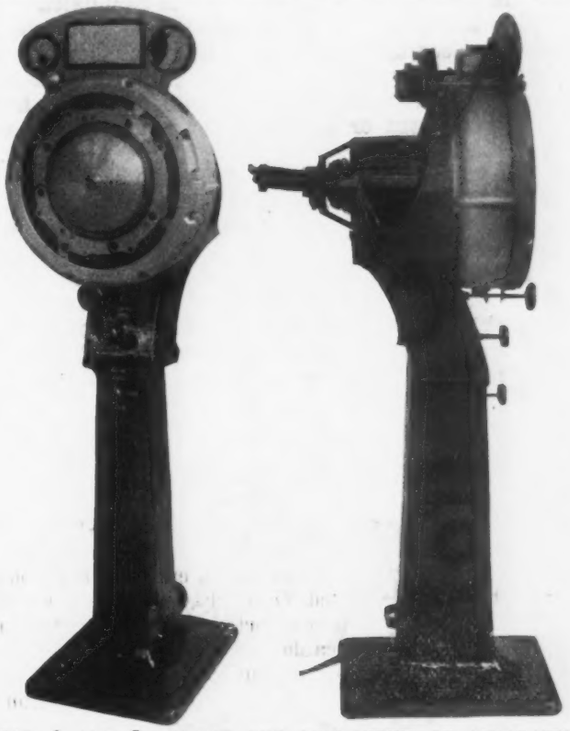
ELECTRIC PARING MACHINE

the vegetables back to the center of the disk, from where they are again taken to the side of the cylinder. This operation is repeated until the skins are removed. No tearing, pounding or brusing of the vegetables, it is declared, can result. Water is continuously sprayed over the contents of the hopper, washing and cleansing the vegetables and carrying off the parings and dirt through a waste outlet to the sewer. When the vegetables are pared sufficiently a door may be opened without stopping the machine and the contents can be emptied into any suitable receptacle.

This machine is manufactured by the American Paring Machine Company, Philadelphia, Pa., and the motor used in its operation is the product of the Diehl Manufacturing Company, Elizabeth, N. J.

Demonstrating Operation of Automobile Motor-Generator

The apparatus shown in the accompanying illustrations was used at the Chicago automobile show by the United States Light & Heating Company, to demonstrate the operation of its inherently regulated motor-



FIGS. 1 AND 2—FRONT AND SIDE VIEWS OF APPARATUS, DEMONSTRATING OPERATION OF MOTOR-GENERATOR

generator for automobile lighting and starting. This equipment was described in the *Electrical World* of Jan. 10. The machine is mounted on a pedestal as shown and is driven by a small direct-connected motor. An ammeter and a tachometer are attached to the top of the pedestal. The motor develops 1 hp at 2000 r.p.m. This speed is exceeded sometimes during the demonstrations and is of course much higher than that attained in actual automobile service. The generator is designed to commence charging the battery at approximately 250 r.p.m. and gives a maximum output at about 500 r.p.m. The generator, therefore, requires little more than 0.25 hp for maximum delivery.

"Aero" Cable Car

The Aero cable car, illustrated herewith, weighs only 20 lb. complete and is constructed entirely of cold-rolled steel and crucible-steel castings, except the seat and pick-up roller, which are of oak. All metal parts are sherardized. The car is arranged so that it can be taken down in four parts, as shown in Fig. 1. The

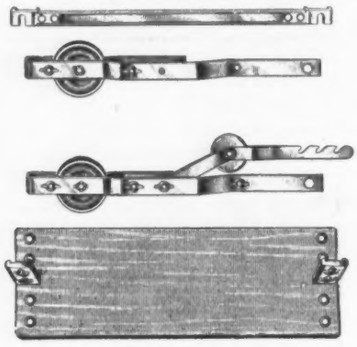


FIG. 1—DETACHED PARTS OF CAR

parts interlock in such a way that it is not necessary to take off any of the bolts or nuts when assembling or disassembling. All bolts are "upset," so that possibility of their becoming detached or lost is eliminated.

The wheels of the car, which ride on the messenger wire, are corrugated in such a way that they will pass freely over any cable hook or hanger. An adjustment is provided on the car which permits the latter's height to be increased or decreased for a long-bodied or a short-bodied man.

The brace bar which runs across the back of the car can be adjusted to the upper or lower position while the car is being used. Fig. 2 illustrates this bar in its upper position.

The attachment shown to the right of the car in Fig. 2 is called the pick-up roller and can be adjusted to different positions, according to the length of hooks or hangers used, so that the cable can be fixed at its proper distance from the messenger wire. Without this pick-

FIG. 2—WORKMAN USING CAR

up attachment the workman would be compelled to hold the cable in position for attaching hooks.

The minimum weight of this car and the small space it occupies when knocked down make it especially valuable to telephone men. One man, for instance, can place the car and tools on a motorcycle and go miles into the country to repair a cable, whereas the same operation with a heavy car would require two men and a wagon, or the shipment of car and tools.

Separable Attachment Plug

Neatness and small size are the features of a separable attachment plug manufactured by the H. T. Paiste Company, Philadelphia, Pa. The device, which is illustrated herewith, is equipped with a fiber washer which slips down the shaft and fits into a shoulder in the edge of the cap. This washer covers the ragged

FIGS. 1 AND 2—PLUG COMPLETE AND FIBER WASHER RAISED FOR WIRING

wire ends and acts as a protection against accumulations of dirt.

When installing, the washer is slipped off, leaving the contact screws exposed and easy to wire. A firm grip and good contact are secured by using folded bronze springs in the base. Nibs on these springs catch on recesses in the brass bars of the cap.

Terminal Connectors

In the illustrations herewith is shown an instrument terminal connector which has been put on the market by the Meliorate Manufacturing Company, 290 Taaffe Place, Brooklyn, N. Y. The body, which is made of hard-drawn brass, nickel-plated, is designed to accom-

FIG. 1—FIRST STEP IN INSTALLATION OF CONNECTOR

modate the insulated portion of the wire, thus preventing the braid from fraying or sliding back from the terminal. The body reinforces the sleeve throughout.

The insulated sleeves are painted either red or black to denote opposite polarities. The sleeves are polished and moisture-proof, and they are said to be unaffected

FIG. 2—SECOND STEP IN INSTALLATION OF CONNECTOR

by temperatures up to 180 deg. C. The sleeve is the locking element, and when in position the wire cannot be removed from the terminal unless the sleeve is forced back and the contact face released. The contact faces

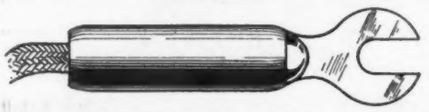


FIG. 3—CONNECTOR WITH SLEEVE IN POSITION

are interchangeable, and one pair of leads may be used for different kinds of service without removing the body from the wire. In Fig. 1 is shown the first step necessary in the installation of the device; in this operation the copper strands should be twisted and the wire bent as shown. Fig. 2 illustrates the second step; the wire is inserted in the binding hole and the binding screw is tightened. Fig. 3 shows the connector (full-size) after the sleeve has been forced into position.

Electric Washer and Wringer

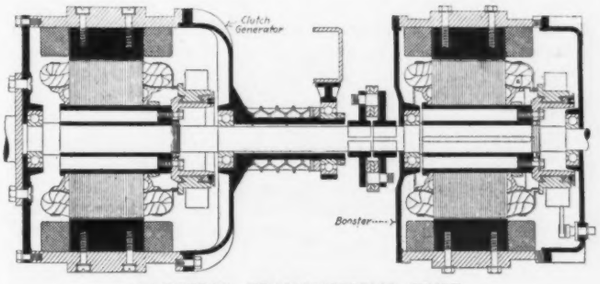
The electric washer and wringer shown herewith has been put on the market by the Horton Manufacturing Company, Fort Wayne, Ind. The machine is equipped with cut gears, thus making its operation practically noiseless and reducing friction to a minimum. The wringer has two reversible rolls which are supported

WASHER AND WRINGER WITH ELECTRIC DRIVE

on ball bearings. An automatic safety release is provided to protect the careless operator. By means of a special attachment, the washer and wringer can be operated by hand in case of temporary motor trouble. The motor used in driving this apparatus is the product of the Fort Wayne Electric Works, Fort Wayne, Ind.

Electric Transmission for Automobiles

An electric transmission unit which replaces the flywheel, clutch, change-speed gear set, electric cranking equipment and lighting generator on automobiles was exhibited on a foreign car at the recent New York automobile show. This unit, which is placed directly back of the engine crank case, consists of two direct-current dynamos with their armatures mounted on a



ELECTRIC TRANSMISSION UNIT

common shaft connected with the drive wheels. One dynamo serves as a combined magnetic-drag clutch and generator, the other acts as a booster motor which assists in driving the car at intermediate speeds.

The field yoke of the clutch generator is rigidly connected to and revolves with the engine crank shaft, at the same time magnetically dragging around with it the armature at a definite slip which depends on the current flowing in the latter's coils. Instead of wasting in resistance the energy generated by this slip, this power is utilized at intermediate speeds to drive the booster motor, whose field yoke is fastened to the chassis. A cross-section of the transmission unit is shown in the accompanying illustration. The gradation from low speed to high speed is accomplished by gradually decreasing the booster field excitation and finally short-circuiting the clutch generator's brushes at high speed.

By decreasing the booster field excitation more current is drawn from the clutch generator, thereby increasing the magnetic drag on the latter's armature and consequently reducing the slip. At intermediate speeds the efficiency of transmission is therefore the combined efficiency of the two dynamos, while on high speed the efficiency is that of the clutch generator alone.

When operating at high speed the booster is no longer a motor but is converted into a generator to charge the storage battery. Provision is made for charging either at a 10-amp or a 30-amp rate. The booster may also be employed as an electric brake by placing the controller handle in the neutral position. Electric cranking is accomplished by operating the clutch generator as a motor on storage-battery energy.

Battery current is not drawn upon except in starting the engine. With this gear the gasoline engine can be run at its most efficient speed, all speed variations of the car being governed through the electrical transmission, thus avoiding the jolts sometimes resulting from sharp speed changes. The outfit weighs practically the same as the parts it replaces and costs only $25 to $30 more.

Creeping Conduit Threader

A conduit threader of a new type recently brought out by the Specialty Device Company, Cincinnati, Ohio, was exhibited for the first time at the National Independent Telephone Association's convention, Hotel La Salle, Chicago. As shown in the accompanying illustration, the device consists of an ingenious arrangement of springs, levers and grips mounted on a center rod in such a way that the entire device "walks" or creeps through the conduit when a series of pulls or jerks is exerted on the trailing rope. As will be noted from the construction of the device, a pull on the trailing rope puts in tension the four smaller ropes which run parallel to the center rod and also compresses the main spring behind the lever. When slack is let into these ropes again the spring expands to its original position, forcing the forward set of levers ahead for another step. Steel grips at the extremities of these groups of levers engage the interior of the conduit and hold the levers in position when an attempt is made to dislodge them. In case the device should encounter an obstruction while threading a conduit preventing its further

CONDUIT THREADER

progress, an extraordinarily sharp jerk on the rope will trip the spring holding the levers in the extended position and the device may then be pulled back to the starting point without difficulty. It is said that the creeper will traverse any conduit which may be threaded with rods and will pass around bends of long radius. With a trailing rope of ordinary sash cord the conduit creeper will thread a pipe at the rate of approximately 60 ft. per minute.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Hydroelectric Energy for American Woolen Company.—The Central Maine Power Company has obtained a twenty-year contract at Skowhegan, Maine, to supply electrical energy to the American Woolen Company's mills, 385 hp being required by June 1. On Feb. 1 the company will deliver 135 hp at the Marston Woolen Mills. It is anticipated that as a result of the development of hydroelectric power by the Central Maine Company the American Woolen Company will erect a new factory in the Skowhegan district.

Electrical Manufacturer Expanding Plant.—The Hill side plant of the Wagner Electric Manufacturing Company, 6400 Plymouth Avenue, St. Louis, Mo., is being expanded by the addition of a new building to cost $150,000, which will be devoted largely to the manufacture of the smaller products turned out by this company. The building in question is to be of reinforced-concrete construction throughout, four stories high, and will occupy a ground area of 272 ft. by 45 ft. When it is completed about 400 employees will be added to the company's payroll, which numbers at present over 1800.

Fuse Manufacturer to Build Larger Factory.—The Appler Refillable Fuse Company has asked the new Chamber of Commerce, of Syracuse, N. Y., for aid in finding a desirable location for temporary use until a new factory building can be erected to meet its requirements. The company proposes to manufacture, under the Appler patents, a complete line of refillable inclosed fuses of all voltages and capacities. G. W. Appler, president of the company, has spent several years experimenting with refillable inclosed fuses for heavy railroad and power work, and the company expects to place on the market a thoroughly reliable and practical fuse with a first cost not exceeding that of a non-refillable inclosed fuse.

Louisville Manufacturer to Install Motor Drive.—One of the largest electrical power installations of the year in Louisville, Ky., promises to be that of the American Oak Leather Company, which operates a large tannery and leather-cutting plant. The company has been using a few motors for the operation of its cutting machines and likes this form of power so well that an engineering examination of the plant is now being made with a view to putting in motors all through the tannery. The steam plant will be retained, and a generator of about 200-kw rating will be installed, together with a corresponding horse-power in motors. The leather company will be in a position to discuss machinery purchases in the near future. Its principal office is in Cincinnati, Ohio. F. E. Mooney is president, H. H. Bechtel secretary, and J. F. Taylor treasurer of the American Oak Leather Company.

Electrical News from the Isthmus.—The American Rotary Valve Company has obtained the contract for supplying the vacuum cleaning system in the new administration building at Balboa. This contract calls for six vacuum cleaning machines, equipped with 20-hp motors of the 230-volt, three-phase, twenty-five-cycle type, together with a complement of special valve and renovator fixtures and a supply of vacuum hose. In order to supply the shops at Balboa with electrical energy before the permanent electric system is in operation, the Miraflores power plant is being supplemented by the installation of one of the three generating units formerly in operation in the steam plant at Gatun. The unit consists of a Curtis steam turbine, directly connected to a 2200-volt, 60-cycle alternator. The American Bridge Company has started to make deliveries on the structural steel for the four substations to be erected as distributing centers for the energy generated at the Gatun hydroelectric plant.

Turbine Business Has Good Outlook.—In response to a request for information concerning the recent progress in the turbine business, the following statement was given out by the Terry Steam Turbine Company, of Hartford, Conn.: "The C. H. Wheeler Manufacturing Company has recently ordered from us two 300-hp non-condensing turbines, which will be used to drive the condenser auxiliaries for the new 15,000-kw turbine being installed by the Consolidated Gas, Electric Light & Power Company, of Baltimore. Our prime-mover business has been greatly stimulated during the past few months, but whether this is due to a natural increase in business or to the pushing of our 'return flow' turbines is hard to say at the present time. The latter type represents the latest improvement in our product and is especially designed for mixed-pressure and low-pressure work."

Cost Analysis in Chicago Electric Garage.—With the installation of a 100-kw and a 25-kw motor-generator set, a six-panel switchboard and additional charging circuits and meters, the Royal Electric Garage, 556 East Fortieth Street, Chicago, will make an effort to analyze the charging costs of the cars in its care. In addition to the meters installed by the Commonwealth Edison Company, the garage owners will connect a graphic meter on the alternating-current circuit to determine the characteristics of the garage load and will use direct-current meters to obtain records for each car. At present the garage has space for accommodating 140 machines with facilities for charging 65 cars simultaneously. Mr. G. H. Gamper, who was formerly connected, in a managerial capacity with central-station properties in Ohio, is general manager of the Royal Electric Garage.

Urges Surety Companies to Demand Uniform Contract Standards.—At the annual meeting of the American Society of Engineering Contractors, held in New York City on Jan. 16, one of the most important features was the presentation of a report by W. B. King, a prominent Washington lawyer and chairman of the sub-committee on public construction contracts, in which he offered certain suggestions advocating the establishment of more uniform and satisfactory contracts on municipal and other government work. He said that a movement to this end would receive the hearty support of the various credit and contracting associations and seemed to think that the quickest method for producing the desired changes would be to obtain combined action by the leading surety companies which bond contractors and are therefore primarily interested in their success or failure.

Central-Station Energy for Ford Automobile Building in Chicago.—The Ford Motor Company, of Detroit, has recently erected a large factory at South Wabash Avenue and East Fortieth Street, Chicago, where parts of cars made in the home factory are assembled for the Chicago district. Electrically driven elevators, pumps and other machinery have been installed throughout the building, energy being taken from the mains of the Commonwealth Edison Company. Of the 738 lighting circuits installed, twenty-four are used to supply energy to electric signs on the roof. Although the service entering the building has been installed for an ultimate rating of 500 hp, there is now in service but 200 hp in motors and about 150 kw in lighting. The switchboard has been placed at the end of the building, so that it will stand near the center of distribution when the building has been extended to its ultimate size. The factory, just completed, is of modern concrete construction, six stories high, with ground dimensions of 164 ft. by 230 ft. Twelve buildings of a similar type have been planned or built by the Ford Company for other cities of the United States which are considered centers of distribution for the company's product.

To Build Carels Diesel Engines in This Country.—Arrangements have been completed through W. R. Haynie, American representative of Carels Frères, of Ghent, Belgium, for the manufacture of that company's type of Diesel engine in this country. The major part of the capacity of a large foundry and manufacturing plant has been secured for this purpose, and this plant will turn out principally engines of from 750-hp to 4000-hp rating, two-stroke cycle, single-acting, of the same general type as those already sold for industrial drive purposes to several American companies, including Phelps, Dodge & Company and the Coronet Phosphate Company. Carels Frères have had an experience of many years in the building of these engines, and it is planned to combine with this knowledge of design the production economies and facilities of an American factory, to supply Diesel engines in large units to the American trade.

Cleveland Electrical Exposition Proposed.—The Electric League of Cleveland is planning to hold an electrical exposition in that city some time in May, the exact date having not yet been fixed. This was announced Thursday of last week, following the adoption of a resolution indorsing the plan as presented by a committee appointed some weeks ago to investigate the advisability of undertaking an enterprise which involves so much work and expense. Representatives of about fifty manufacturing and sales companies agreed at this meeting to take space and co-operate in every way possible to make the exposition a success. M. T. Turner, of the Cleveland Electric Illuminating Company; N. H. Boynton, of the National Lamp Works, and T. B. Cagwin, of the Cleveland Telephone Company, compose the committee which made the investigation, and the report was presented by W. G. Rose, civic expert, who has had charge of most of the expositions and displays in Cleveland for some years past. The purpose of the exposition, as expressed by the report, is to advance the general interests of the electrical trade in Cleveland and vicinity; to educate the community as to the advantages of electricity for illumination, industrial power and general household use; to show the variety and scope of time and labor-saving devices operated by electricity; to make Cleveland the nation's electrical market during the period of the exposition, and finally to cause Cleveland to be known as "the Electrical City." Cleveland is the home of some of the largest electric companies in the country, and its financial men have been prominent in the promotion and operation of many other concerns making electrical devices and machinery, as well as in building electric railways and light and power plants in different sections of the country. Of late years the city has produced some of the finest and best electric automobiles, and the development of all these enterprises is yet in its infancy. For this reason as well as others it is believed that the exposition will prove a great success and awaken renewed interest in electrical matters. The following interests are among those which agreed to participate in the exposition: National Electric Lamp Association, Cleveland Telephone Company, Nungesser Carbon & Battery Company, Electric Welding Products Company, Adams-Bagnall Company, A. & W. Electric Sign Company, Western Electric Company, General Electric Company, Van Dorn Electric Tool Company, Case School of Applied Science, American Steel & Wire Company, Republic Electric Company, Chicago Pneumatic Tool Company, Cleveland Crane & Engineering Company, Electrical Contractors' Association, Cleveland Armature Works, Westinghouse Electric & Manufacturing Company, Electric Controller & Manufacturing Company, Cleveland Electric Illuminating Company, National Carbon Company, Gould Electric Storage Battery Company, Standard Underground Cable Company, Rauch & Lang Carriage Company, Leonard-Bundy Electric Company, Cleveland Switchboard Company, Johns-Manville Company, Sangamo Electric Company, Esterline Company, J. A. Roebling Sons Company, Electric Products Company and Electric Storage Battery Company.

Central-Station Service for Chicago's Largest Office Building.—Final contracts have been closed by which the Commonwealth Edison Company will furnish electrical energy for all purposes for the new office building of the Continental and Commercial National Bank of Chicago. This building occupies an entire city block and fronts on West Adams Street, South LaSalle Street, Quincy Street and South Fifth Avenue. It is the largest office building in the city, being 260 ft. high, extending 323 ft. on the east-and-west streets and 166 ft. on the north-and-south streets. It contains twenty stories, the main banking room being elaborately decorated and extending through several floors. Articles descriptive of the electrical equipment of this imposing building were printed in the *Electrical World* of July 26, 1913, pages 189-194, and Sept. 13, 1913, page 542. The greater portion of the available space in the building will be rented to tenants. The bank has entered into a long-term contract with the Commonwealth Edison Company by which it will buy all the electrical energy needed for the building at wholesale rates. In turn the bank will supply tenants at the regular retail schedule of the Edison company. Electricity is used for lighting and practically for all mechanical requirements. Heating will be furnished on a meter basis by the Illinois Maintenance Company, which is allied to the Commonwealth Edison Company. Four 500-hp boilers will be placed in the basement of the building and will be maintained and operated by the Maintenance company, the steam for heating being furnished on a metered basis. Electrical energy will be taken from the direct-current 115-230-volt mains of the Edison company. The building is to be ready for occupancy May 1, 1914. It is estimated that the electrical requirements for a year will be about 1,800,000 kw-hr. The total motor load is 1498 hp, of which 940 hp will be required for the twenty-six electric elevators, 283 hp for ventilating fans and 275 hp for pumps and miscellaneous machinery. The lighting load will consist of about 20,000 50-watt equivalents. The bank will occupy practically all of the building up to and including the fourth floor, with space also on the fifth and sixth floors. The Continental and Commercial National Bank is the largest in Chicago in amount of deposits and is said to be the second largest in the United States. The total lighting requirements for the bank and for the public lighting, as distinguished from tenant lighting, will amount to about 8000 50-watt equivalents, leaving 12,000 50-watt equivalents for tenants. Twelve of the elevators will run from the basement or the first floor to the twelfth story; ten express elevators will run from the first floor or the basement to the twentieth floor; two combination elevators will run from the sub-basement to the attic, and two private elevators for the use of the bank employees will run from the basement to the sixth floor. The building will contain a substation of the Commonwealth Edison Company. D. H. Burnham & Company are the architects for the building. Mr. Samuel Unsull, president of the Commonwealth Edison Company, and Mr. George M. Reynolds, president of the Continental and Commercial National Bank, personally interested themselves in the terms of the contracts by which electrical energy and heating will be supplied to the building. On the part of the central-station company the details of the contracts were worked out by Mr. P. Junkersfeld, assistant to the vice-president, and Mr. S. M. Bushnell, engineer of the contract department.

NEW YORK METAL MARKET PRICES

	Jan. 20 Bid	Jan. 20 Asked	Jan. 27 Bid	Jan. 27 Asked
Copper:				
Standard, spot*	....	14.50	.....	14.50
	Selling Prices		Selling Prices	
	£ s. d.		£ s. d.	
London, standard, spot*	64 12 6		65 12 6	
Prime Lake	14.50 to	14.62½	14.75 to	15.00
Electrolytic	14.30 to	14.40	14.50 to	14.60
Casting	14.15 to	14.25	14.30 to	14.40
Copper wire base	15.50	.....	15.75	.....
Lead	4.10		4.10	
Nickel	40.00 to	45.00	40.00 to	45.00
Sheet zinc, f.o.b. smelter	7.50		7.25	
Spelter, spot	5.25 to	5.35	5.35 to	5.40
Tin, spot	37.70 to	38.00	39.12½ to	39.37½
Aluminum:				
Prompt delivery	18.75 to	19.00	18.75 to	19.00
Future	18.75 to	19.00	18.50 to	18.75

***OLD METALS**

Heavy copper and wire	13.50	13.62½
Brass, heavy	8.75	8.87½
Brass, light	7.75	7.87½
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

***COPPER EXPORTS**

Total tons to Jan. 27 30,349

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Reorganization of Michigan Electric Stove Manufacturer.—The reorganization of the Copeman Electric Stove Company, of Flint, Mich., has been perfected. The capital stock has been reduced from $500,000 to $200,000 and the company will issue $100,000 new 7 per cent cumulative preferred stock. This concern was organized Aug. 14, 1911. The reorganized company will manufacture an improved model of the Copeman stove.

Forthcoming Annual Meeting in Chicago.—The annual meeting of the stockholders of the Commonwealth Edison Company, of Chicago, will be held at the office of the company, 120 West Adams Street, on Feb. 24, at noon. The transfer books of the company will be closed at 1 p. m. on Feb. 14 and will be reopened at 10 a. m. on Feb. 25. The annual meeting of the Public Service Company of Northern Illinois will be held at the office of the company, 137 South La Salle Street, Chicago, at 2:30 p. m., on Feb. 24. Transfer books will be closed in like manner with those of the Commonwealth Edison Company.

Great Western Power Company Has Prosperous Year.—Gross earnings of the Great Western Power Company from operation during the year ended Dec. 31 reached a total of $2,698,214, with net earnings of $1,732,244 for the same period. The company has been expanding its properties rapidly during the past year. Bonds were issued in the early part of 1913 and construction work has progressed on the generating station at Big Bend and on the impounding dam at Big Meadows, Cal. The capital stock of the Great Western Power Company is $27,500,000, all outstanding and all owned by the Western Power Company.

Central Union Telephone Company Receivers Decided Upon.—In the suit brought by William A. Read and others, against the Central Union Telephone Company, an agreement has been reached as to the receivers to be chosen, but no official appointments have been made. Those chosen are David R. Forgan, president of the National City Bank, of Chicago; Edgar S. Bloom, of St. Louis, Mo., vice-president of the Bell Telephone Company of Missouri, and Frank F. Fowle, of New York City, consulting electrical engineer. In the Jan. 10 issue of the *Electrical World* a lengthy note appeared, reviewing the causes back of the suit.

Annual Report of the Detroit Edison Company.—The report of the Detroit Edison Company for the year ended Dec. 31 showed the largest increase of earnings in its history. Gross earnings were 26.6 per cent larger than the figures for the preceding year. Great financial activity marked the company's progress in 1913. Early in the year a big increase in the common stock was made, and later a bond issue was found necessary, while at the close of the year a plan was inaugurated for the issue of a large amount of both stock and convertible bonds. This activity was a reflection of unprecedented construction and expansion activity on the company's properties. Gross earnings for 1913 amounted to $5,546,587 and net earnings to $2,324,360.

The United Gas & Electric Engineering Corporation Formed.—A company has been formed under the above name, with a capital stock of $100,000, all of which is owned by the United Gas & Electric Corporation, of New York. The new company will engage in the purchasing of supplies and material and has become the purchasing department of the owning corporation. It will also carry on a general consulting engineering and contracting business, paying special attention to the needs of the operating companies subsidiary to the United Gas & Electric Corporation and the American Cities Company. The officers of the new company are: George Bullock, president; S. J. Dill and J. S. Pevear, vice-presidents, and B. F. Wood, chief engineer. Its directors are George Bullock, S. R. Bertron, R. E. Griscom, J. S. Jenks, Jr., and John Gribbel.

Merger of Electric Vehicle Manufacturing Interests.—The Argo Electric Vehicle Company, of Saginaw, Mich., the Brock Electric Company, of Cleveland, Ohio, and the Borland-Grannis Company, of Chicago, all manufacturers of electric vehicles, have merged their businesses under the name of the American Electric Car Company, and will transfer their interests to Saginaw, where the various cars formerly manufactured in the cities of Saginaw, Cleveland and Chicago, respectively, will be continued under their present individual names. Frederick A. Brand, of Cleveland, will be president of the new company; Bruce Borland and U. B. Grannis, of Chicago, vice-presidents, and Theodore Huss, of Saginaw, secretary and treasurer. A number of additions will be made to the Argo factory to provide for the increased production under the new arrangement.

Progress of the Electrical Securities Corporation.—In 1904 the Electrical Securities Corporation was organized for the purpose of buying the securities of various public utility electric corporations and issuing against these its own collateral trust bonds. Since its organization $8,500,000 of the latter have been issued, of which $3,896,000 are outstanding. The capital stock of the Electrical Securities Corporation consists of $2,500,000 common and $1,000,000 of 5 per cent cumulative preferred stock, and the dividend rate during 1913 was 10 per cent per annum. The report of the company for the year ended Dec. 31 showed continued activity. Its gross earnings were $500,834 and its net earnings amounted to $249,295 for that period. The surplus for the past year amounted to $317,276 and the total surplus at the beginning of the present year was $1,287,221. The company is a subsidiary of the General Electric Company, of Schenectady, N. Y., and through this concern and the Electric Bond & Share Company, organized in 1905, the General Electric financial interests are handled.

Southern California Edison on 6 Per Cent Basis.—In the Nov. 15 issue of the *Electrical World* the statement was made that an increase in the dividend rate on the common stock of the Southern California Edison Company was anticipated, and the recent action of the directors in naming a quarterly dividend of 1½ per cent fulfilled this prediction. The preferred stock will also be on a 6 per cent per annum basis, starting with the April payment. This company recently issued $2,000,000 of new common stock, which was taken by the stockholders at 85. Since that move word has come of a proposed reduction in the maximum lighting rate over the entire southern portion of California from 8 cents to 7 cents per kw-hr. About a year ago the rate was reduced from 9 cents to 8 cents, and in spite of it the company's earnings showed a normal increase. The new rates will take effect on March 1. During the past ten years the gross earnings of the company have increased 445 per cent, the net earnings 465 per cent and the surplus 541 per cent. And in the same time there has been an increase in the connected lighting load of 452 per cent and the power load has increased 1928 per cent.

United Properties Company Reorganization.—An agreement was recently reached in San Francisco by which the interests of F. M. Smith in the United Properties Company of California and subsidiaries were sold to G. C. Moore, of Detroit, Mich., and an English syndicate. This move is considered favorable to Messrs. Tevis and Hanford, who have been negotiating lately for the acquisition of the Smith interests in the properties. This deal will be submitted for the approval of the California Railroad Commission and is contingent upon the action of that body. If approved, its result will be the disintegration of the United Properties Company of California and the reorganization of the subsidiary companies into a new holding company. The railroad properties will be segregated and their financing will receive special attention. Provision has been made for the extension of the $2,500,000 short-term notes held by N. W. Halsey & Company to Sept. 12, 1914, and the $1,150,000 collateral trust notes on the Key Route Basin property to Nov. 20, 1914. The immediate outlay required from the Moore associates was only $1,890,000, covering the purchase of 38,000 shares of preferred stock from the United Properties trustees and 25,000 shares of the same from the Smith trustees. Sufficient of the common stock was secured, together with the above and without payment, to give the purchasers a 70 per cent control. The total outlay necessary for the retirement of the company's entire obligations and for the payments on new work already under contract, amounts to $9,890,000. This agreement, as above outlined, will remove the cause of the recent differences between the original consolidators of the properties, will take care of the immediate financial obligations of the company, and will give a fixed value to the stock in the hands of the company's creditors.

Business Notes

The Cortlandt Engineering Company, formerly at 146 Liberty Street, has moved its office to 42 Broadway, New York City.

H. Olin Jones, architect and engineer, of Greenville, S. C., has announced the removal of his office from the Masonic Temple to the Skelton Building in that city, thereby gaining enlarged quarters.

The Manhattan Brass & Electrical Company, of 218 Grand Street, New York, is carrying on a jobbing business in brass and glass supplies for the electrical trade. Harry Helfman is president and Samuel Denemark is secretary and treasurer of the concern.

The Gray Brothers Electric Company, of Detroit, Mich., has recently secured the services of M. N. Murphy, who will have full charge of its electrical construction work. Mr. Murphy has served in various electrical engineering capacities for the past twelve years, with the Western Electric Company, the Johnson Electric Company, of Omaha, Neb., and the George A. Fuller Construction Company.

The A. & T. Storage Battery Company, with offices in the U. S. Rubber Building, New York City, will complete its manufacturing arrangements about April 1, when it will start the production of storage batteries for various services. The officers of the company are J. M. Splitdorf, president; W. C. Albers, vice-president, and D. B. Nally, secretary and treasurer. Mr. Splitdorf was formerly connected with the Splitdorf Electrical Company, of Newark, N. J.

The International Steam Engineering Company, with main office in the Grant Building, Atlanta, Ga., and branches in the Realty Trust Building, Charlotte, N. C., and in the Brown-Marx Building, Birmingham, Ala., took over on Jan. 1 the Southern territory agency for the Kerr Turbine Company, of Wellsville, N. Y. J. E. Weinbold will give personal attention to new business in territory including North and South Carolina and eastern Tennessee; Robert Stevens to Mississippi and Alabama, and W. R. Jennison to all other Southern territory.

New Industrial Companies

The Scientific Appliance Company, of Guttenberg, N. J., has been incorporated by E. Blum, E. Hunke and K. Hunke, of Guttenberg, N. J. The company is capitalized at $25,000 and purposes to deal in electro-medical apparatus and mechanics.

The Nitro Electric Corporation, of Glenn Ridge, N. J., has been incorporated with a capital stock of $50,000 by M. S. Powell, H. De G. King, of Glenn Ridge, and G. Colvin, of New York, N. Y. The company proposes to manufacture electric appliances, lamps, etc.

Crannell, Nugent & Kranzer, of New York, N. Y., have been incorporated with a capital stock of $15,000, to manufacture and deal in electrical apparatus. The incorporators are L. W. Crannell, F. L. Nugent and W. J. Kranzer, 507 171st Street, New York, N. Y.

The Case Heat-Signal Company, of New York, N. Y., has been chartered with a capital stock of $25,000 to manufacture and deal in electrical and mechanical instruments. The incorporators are C. A. Case, Joseph Hahn and W. S. Kain, 757 Sixth Avenue, New York, N. Y.

The Stromberg Electric Company, of Augusta, Maine, has filed articles of incorporation under the laws of the State of Maine with a capital stock of $490,000 to manufacture and deal in time-recording devices of all kinds. I. S. Kearney, of Augusta, Maine, is president and treasurer.

The International Engineering Corporation, Ltd., of Portland, Maine, has filed articles of incorporation under the laws of the State of Maine with a capital stock of $100,000 for the purpose of doing an electrical, mechanical, mining and civil engineering and general contracting business. The officers are A. F. Jones, president, and T. L. Croteau, treasurer, both of Portland, Maine.

Trade Publications

Storage Batteries.—The "Exide" storage batteries for automobile service are treated in Section X of the publications of the Electric Storage Battery Company, of Philadelphia, Pa.

Car Replacer.—The Electric Service Supplies Company has issued a leaflet illustrating its F. & P. car replacer and St. Louis trolley pick-ups. Both of these are urged as being profitable equipment for every car.

Electric Meat Slicer.—The A. J. Deer Company, Hornell, N. Y., is mailing illustrated folders relating to its "Royal" electric meat slicer. This device is self-contained with motor complete and is ball-bearing throughout.

Wire Pocket Book.—The Simplex Wire & Cable Company, of Boston, Mass., has issued recently a handy pocket manual on its product, giving among other things tables of wire weights, properties and prices, freight charges and test methods.

Rectifier.—The Mohawk Electric Manufacturing Company, Newark, N. J., in a recent catalog describes fully its alternating-current rectifier for charging storage batteries. All the information that the prospective user might wish to have is clearly set forth.

Public Utility Securities.—Stone & Webster, of Boston, Mass., have recently issued a booklet showing the condition of a number of the properties under their management. This publication should be of interest to prospective investors in public utility securities.

Portable Engines.—The Kansas City Engine Works, 1613 Crystal Avenue, Kansas City, Mo., in a recently published leaflet briefly describe the Elliott portable engines of various ratings. The igniter which is furnished with each 6-hp Elliott engine is also shown.

Lamp Guards.—The Electric Service Supplies Company has issued an attractive folder describing and illustrating its Keystone lamp guards. An effective illustration shows in detail the construction of its portable type. A conduit box type is also shown and listed.

Lighting Fixtures.—The "Multi-Lux" standard semi-indirect lighting fixture is the subject of a leaflet recently issued by the Multi-Lux Illuminating Company, The Arcade, Cleveland, Ohio. Its construction and an outline of its special features are given, together with a number of effective illustrations.

Motor Starters.—The Allen-Bradley Company, Milwaukee, Wis., has its imprint on a broadside referring to its type "H" motor starter. An effective fac-simile blueprint illustration shows the constructive features of this apparatus, and terse descriptions of its various parts will interest the prospective purchaser.

Instruments.—Electrical measuring, testing and scientific instruments, manufactured by Foote, Pierson & Company, are the subject of a comprehensive catalog of 100 pages. Each type of instrument is described in detail and is illustrated. A new universal photometer designed by Messrs. Clayton Sharp and P. S. Millar is discussed in this catalog.

Fans.—The 1914 catalog of the Robbins & Myers Company, Springfield, Ohio, gives illustrations and data regarding its direct-current and alternating-current ceiling, desk, oscillating and exhaust fans. The four center pages of the catalog are printed on heavy, lusterless paper, and the reading matter in this section is illustrated with human-interest pictures that show the uses of fans in the home and office. The two illustrations in color are attractive as well as the unique design on the front cover.

Electric Vehicle Charging Stations in New York City.—Owners of electric vehicles will find useful the booklet of information concerning charging stations within 150 miles of New York City, including a route map, which has just been issued by the New York Electric Vehicle Association. Among the data therein compiled and printed for the first time are rates charged for "boosting," the hours during which service may be had, and the maximum amperage and voltage available. These facts were secured in co-operation with the automobile bureau of the New York Edison Company. The booklet has been sent to all owners of electric vehicles in New York City and upon request a copy will be mailed to any one desiring it.

Personal Mention

Mr. E. Sloneker has resigned as electrician of the borough of Kutztown, Pa., to engage in the electrical supply business.

Mr. H. D. Fitch has succeeded Mr. R. A. Field as general manager of the Kentucky Public Service Company, Hopkinsville, Ky.

Mr. A. J. Short has received the title of superintendent of the Frankfort (Ky.) plant of the Kentucky Public Service Company.

Mr. F. D. Schaffer has been appointed general manager of the Chickasha (Okla.) Light, Heat & Power Company, vice C. G. Johnson, resigned.

Mr. R. L. McLellan, formerly associated with H. M. Byllesby & Company, Chicago, has been appointed sales manager of the Merchants' Heat & Light Company, Indianapolis, Ind.

Mr. M. L. Derge, superintendent of the Milligan Company of Elyria, Ohio, has been transferred to act in that capacity with the Trumbull Public Service Company at Warren, Ohio.

Mr. E. E. Bresnahan, who has been connected with the Fort Wayne Electric Works of the General Electric Company for several years, has been promoted to the position of purchasing agent.

Mr. H. C. Moore has been appointed manager for the Kentucky Public Service Company at Frankfort, Ky. Mr. Moore was formerly a member of the company's staff at Bowling Green, Ky.

Mr. A. V. Wynne, formerly electrical engineer of the Trumbull Public Service Company of Warren, Ohio, has been appointed superintendent of the Massillon (Ohio) Gas & Electric Company.

Mr. E. Vinning has been appointed resident local manager of the Idaho Railway, Light & Power Company at Caldwell, Idaho, vice J. D. Orr, who has been promoted to the office of district manager.

Mr. Charles Wirt, president of the Wirt Company, maker of electric-lighting appliances of Philadelphia, Pa., sailed on the S. S. *Berlin,* Jan. 3, for Naples. Mr. Wirt will be absent for about two months.

Mr. Edwin L. Sellars has been appointed new-business manager for the Kentucky Public Service Company, which operates electric-lighting properties in Bowling Green, Frankfort and Hopkinsville, Ky.

Mr. J. B. Johnson, of the Massillon (Ohio) Electric & Gas Company, has been made superintendent of the Milligan Electric Company at Elyria, Ohio, as successor to Mr. M. L. Derge, who has been transferred to Warren, Ohio.

Mr. A. J. Francis has been made manager of the Chicago office of the Fort Wayne Electric Works of the General Electric Company. Mr. Francis has been connected with the Fort Wayne office in Chicago for several years.

Mr. Asa Williams has been appointed superintendent of the Owensboro (Ky.) municipal light and water-works, and not superintendent of the municipal light and water plants of Fresno, Cal., as announced in our issue of Jan. 17, 1914.

Mr. Joseph E. Montague, vice-president and general manager of the Buffalo & Niagara Falls Electric Light & Power Company of Niagara Falls, N. Y., was unanimously elected president of the Niagara Falls Board of Trade at the annual meeting of the organization on Jan. 15.

Mr. J. D. Orr, local manager of the Idaho Railway, Light & Power Company at Caldwell, Idaho, has been promoted to the office of district manager, with headquarters at Nampa. Mr. Orr's territory now embraces the towns of Caldwell, Nampa, Middleton, Murphy, Silver City, Star, Eagle, Homedale, and all the surrounding rural districts.

Mr. R. E. Richardson, general manager of the Commonwealth Power Company, Kalamazoo, Mich., has resigned, and the office of general manager has been discontinued. Mr. Richardson will devote his time to other business interests. The Kalamazoo district will be managed by Mr. F. W. Blowers, present manager of the Kalamazoo Gas Company.

Mr. C. G. Johnson, retiring manager of the Chickasha (Okla.) Light, Heat & Power Company, was the guest of honor at a banquet by business and professional men on Jan. 20. Mr. Johnson will become affiliated with the Vicksburg (Miss.) Light & Traction Company, which is owned by the same interests that formerly owned the Chickasha Light, Heat & Power Company.

Mr. A. L. Pond, until recently Chicago manager for the Fort Wayne Electric Works of the General Electric Company, is now in charge of the Milwaukee office of the General Electric Company. Mr. Pond, who is an electrical man of wide experience, has been prominent in electrical circles in the West for a number of years. He is an associate of the American Institute of Electrical Engineers.

Mr. S. G. McMeen, of the Columbus (Ohio) Light, Heat & Power Company, has been elected president of the East St. Louis Railway, the East St. Louis & Suburban Railway and the East St. Louis Light & Power Company, East St. Louis, Ill., to succeed Mr. C. M. Clark, of E. W. Clark & Company, Philadelphia, Pa., as president of the first two companies and Mr. L. C. Haynes as president of the East St. Louis Light & Power Company.

Mr. McKew Parr has been elected general sales manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn. Mr. Parr, who is a graduate of the United States Military Academy at West Point and a native of Baltimore, has been associated with the Hart & Hegeman Manufacturing Company since 1909. He has been connected with the Maryland Telephone Company, of Baltimore; the Southern Electric Company, of Baltimore, and the Cataract Electric Supply Company, of Buffalo. After representing the Hart & Hegeman Manufacturing Company in its Southern territory for two years, he was appointed advertising manager, in which capacity he continued until his recent promotion.

Mr. Wilbur B. Foshay has resigned his position as manager of the Northwestern Electric Company of Portland, Ore., to engage in general consulting work in the Wilcox Building, Portland, Ore. Previous to going with the Northwestern Electric Company, Mr. Foshay was for two years district manager of the Washington-Oregon Corporation, to which concern he went from the Pacific Power & Light Company. With the latter concern Mr. Foshay served as manager of the Walla Walla (Wash.) office and as manager of the Kansas Gas & Electric Company at Wichita, Kan. Mr. Foshay was at one time manager of the Fort Dodge (Ia.) Light & Power Company and served with the lighting companies in Hutchinson, Kan., and Tarrytown, N. Y. Besides his consulting work, Mr. Foshay will look after his interests in the Washington Public Service Company at Olympia, Wash.

Mr. John Z. Murphy has been appointed electrical engineer of the Chicago Surface Lines. Mr. Murphy entered street railway work in 1889 as chief operating engineer in charge of outside mechanical equipment with the West Chicago Street Railway. When that company changed from cable to electric drive Mr. Murphy was placed in charge of the construction of power houses. In 1900 Mr. Murphy was appointed chief engineer of the Union Traction Company in charge of all engineering work and continued in that capacity when that company was absorbed by the Chicago Railways. For the past seven years Mr. Murphy has represented the Chicago Railways on the Board of Supervising Engineers, Chicago Traction. Mr. Murphy will have charge of power stations, substations, distribution, metering and tunnels in his work with the Chicago Surface Lines.

JOHN Z. MURPHY

Dr. Emil Rathenau, the well-known German engineer, for many years head of the Allgemeine Elektricitäts Gesellschaft, celebrated his seventy-fifth birthday on Dec. 11. Telegrams were received from the Emperor and from Prime Minister von Bethmann Hollweg. The greetings of the

Kaiser were as follows: "By the grace of God you are to-day permitted to look back upon seventy-five years of prosperous work and successful life. It gives me much pleasure to tender you my warmest congratulations in grateful recognition of your valuable services in the development of the German electro-technical industry. Wilhelm I. R." The Prime Minister's message of congratulation was as follows: "Please accept my warmest congratulations on the occasion of completing your seventy-fifth year. You can look back with justifiable pride upon a long life in which inventive genius combined with untiring energy and an iron will have led to a long chain of successes. Your unerring eye for technical and economic possibilities has always enabled you to keep the highest goal in view, and with your infallible business knowledge you have not despised the smallest detail. You have thus created one of the largest industrial undertakings in the German Empire and brought it to the highest state of perfection—a guide in the great economic questions of the day and an example of the strict fulfilment of duty. It is a sincere pleasure to me to express my sentiments upon this day of celebration, with the wish that now after your convalescence from severe illness you will be spared for many years to come."

Mr. H. B. Fleming, formerly vice-president and chief engineer of the Chicago City Railway, has been appointed chief engineer of the Chicago Surface Lines, the official name of the unified properties of the Chicago Railways and the Chicago City Railway. Since its beginning Mr. Fleming has represented the Chicago City Railway on the Board of Supervising Engineers, Chicago Traction. He has been connected with the Chicago City Railway for the past fourteen years. After his graduation from Washington University, St. Louis, Mo., Mr. Fleming was made assistant engineer in the water department of the city of St. Louis. Later he was engaged in street-railway work in the operating and engineering department of the National Railway of St. Louis. When that company was absorbed by the St. Louis Transit Company he continued to serve in the engineering department until 1900. After resigning from the St. Louis Transit Company Mr. Fleming entered the service of the Chicago City Railway, and in 1905 he was appointed chief engineer, being promoted to membership on the Board of Supervising Engineers, Chicago Traction, in 1907. In March, 1912, he was elected vice-president and director of the Chicago City Railway. Mr. Fleming is a member of the American Society of Civil Engineers, the Western Society of Engineers, the Western Railway Club and the American Electric Railway Engineering Association.

H. B. FLEMING

Obituary

H. C. Meinholtz, vice-president of the Heine Safety Boiler Company, St. Louis, Mo., died Dec. 24. Mr. Meinholtz was born Feb. 7, 1868, at St. Louis. He attended the public schools and graduated from the Manual Training School in the fall of 1883. Entering the employ of the Heine Safety Boiler Company shortly after at the age of nineteen as draftsman, he was continuously connected with that company until the time of his death. He was made superintendent in 1895 and a vice-president in 1907. Mr. Meinholtz was a member of the Engineers' Club of St. Louis and of the American Society of Mechanical Engineers.

Dr. Benjamin O. Peirce, Hollis professor of mathematics and natural philosophy at Harvard University since 1888, died at his home in Cambridge, Mass., on Jan. 14. Professor Peirce was a native of Beverly, Mass., and was educated at Harvard University and the University of Leipsic, from which he received the degree of Ph.D. in 1879. His work in the physics department at Harvard began in 1884. Professor Peirce was a member of the American Physical Society and a fellow of the American Academy of Arts and Sciences and many other scientific organizations, besides being the author of several technical works and numerous scientific papers.

Charles F. Prichard, vice-president and general manager of the Lynn (Mass.) Gas & Electric Company and treasurer of the Gloucester (Mass.) Electric Company, died suddenly at his home in Lynn on Jan. 19. Mr. Prichard was one of the most noted gas experts in America, and was prominent in public utility affairs in the East, being a director of the Beverly (Mass.) Gas & Electric Company and prominent in affairs of the Massachusetts Electric Lighting Association. He was a native of Marblehead, Mass., and was educated at the Massachusetts Institute of Technology. In 1883, at the age of twenty-seven, he was made superintendent of the Lynn company, becoming general manager in 1901 and vice-president in 1908.

Edwin Emerson Nolan, head of the materials disposition department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., died at his home in Wilkinsburg, Pa., on Jan. 13. Mr. Nolan began work with the Westinghouse Electric Company in 1887 just about the time it began operations on Garrison Alley in the city of Pittsburgh. He was subsequently made superintendent of the Allegheny factory of the company and as such had charge of building the first alternating-current generators for the Niagara plant. He retained his position until the factory was converted into a foundry. In 1898 Mr. Nolan was sent by the Westinghouse Electric & Manufacturing Company to France to establish a factory at Havre, in which position he remained until 1902. He returned to the United States, and on account of his familiarity with Westinghouse apparatus was placed in charge of the materials disposition department, a position which he held until his death. Mr. Nolan was born in Chicago on Aug. 10, 1857. He is survived by a widow, two sons and two daughters.

William Cooper, director of buildings and equipment of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., died of appendicitis at his home in Wilkinsburg on Jan. 23. Mr. Cooper was esteemed and respected by his associates and by all those who came in contact with him, and he was deeply beloved by those who knew him intimately. A man of great force and character as well as inventive ability, he has left a mark on the electrical engineering industry. Mr. Cooper was born near Watertown, N. Y., Nov. 24, 1861. At the beginning of the nineties he was chief engineer and master mechanic of the Twin City Rapid Transit Company, of St. Paul, Minn., from where he went to join the engineering department of the General Electric Company. There he did some valuable work in connection with the effect of high density in armature cores on the commutation of railway motors. After leaving Schenectady, Mr. Cooper became general superintendent of the Bullock Electric Manufacturing Company at Cincinnati, Ohio, where he developed the multiple voltage system, which was epoch-making in the operation of electrically driven machine tools. He also developed the teaser system for the operation of printing presses. After leaving the Bullock company he joined the Westinghouse Electric & Manufacturing Company, where his inventive faculties found scope in the development of the electro-pneumatic system of multiple-unit train control. His personality was also a great factor in the Westinghouse organization and led to his becoming director of buildings and equipment of the company, which position he held at his death. The electrical industry has lost a valuable man, and those who knew him well have lost one of the truest and most fearless of friends, whom they will mourn for many years.

WILLIAM COOPER

Construction

New England

SKOWHEGAN, MAINE.—The American Woolen Co., of Skowhegan, has entered into a 20-year contract with the Central Maine Pwr. Co. to furnish electricity to the amount of 385 hp to operate its mills. Of this amount 135 hp is to be available at the Marston Mills Feb. 1. The remaining 250 hp is to be delivered at the present shoe factory building, now owned by the American Woolen Co., by June 1.

WESTFIELD, MASS.—Bids will be received until Feb. 9 at the office of the Westfield gas and electric works, Westfield, Mass., for furnishing and installing, complete under one contract, a 600-kw turbine-alternator and condenser. T. T. Logie is manager.

PASCOAG, R. I.—At a meeting of the Pascoag fire district taxpayers held recently it was voted to discontinue the municipal generating plant and purchase electricity from the Rhode Island Transmission Co. to operate the municipal electric-lighting system, to take effect either July 1 or Sept. 1, 1914. The contract is for a period of 20 years.

NEW HAVEN, CONN.—Bids will be received by the board of fire and police commissioners, Department of Fire and Police Service, New Haven, Conn., until Feb. 3, for furnishing the city of New Haven with 3250 ft., more or less, 50-conductor lead-covered underground cables. Each conductor shall be 14 B. & S. gage annealed copper wire. S. J. Metzger is secretary board of fire commissioners.

Middle Atlantic

ARCADE, N. Y.—Within the next 12 months the village of Arcade expects to purchase a general line of supplies for wiring, etc. J. H. Howard is village clerk.

BUFFALO, N. Y.—Bids will be received by Francis G. Ward, commissioner of public works, Room 5, Municipal Building, until Feb. 3, for furnishing and installing the heating and ventilating apparatus in the proposed new 16-room school building on Germain Street, near Amherst Street; also for furnishing material and labor to install the steam-main, pumps, traps, etc., in the tunnel connecting the heating and power plant of the new Technical High School building with the new school building on Clinton Street, corner of Cedar. A separate proposal must be submitted for each division of the work.

FREEPORT, N. Y.—The managers of the municipal electric-light plant expect to purchase miscellaneous supplies, including wire, meters, transformers, etc., for the municipal electric-light system.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Feb. 9, for installing electric equipment in new Public School 97, on Mangin Street, near East Houston Street. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, Park Avenue and Fifty-ninth Street.

SODUS, N. Y.—Within the next 12 months the Wayne Pwr. Co., of Sodus, expects to erect a 6-mile transmission line from Atlanta to Naples (11,000 volts, 35-ft. and 40-ft. poles), also a complete distributing system in Naples, including tungsten series street-lighting system of about 100 40-watt lamps; also to purchase 1000 poles, 40 to 50 miles of bare and weather-proof wire, etc. (transformers and meters now under consideration), one General Electric transformer and a constant-current regulator for street-lighting system. The company is also considering the development of a 200-ft. waterfall, obtaining about 300 kw for four hours. G. R. Mills is president.

WEEDSPORT, N. Y.—At a special election held Jan. 21 the proposal to appropriate $18,000 for a municipal electric-light plant was defeated. On Nov. 26 the taxpayers voted to appropriate $15,000 for the installation of a plant.

WILLIAMSON, N. Y.—Bids will be received by the water commissioners of Williamson, N. Y., until Feb. 11 for the construction of a water-works system, which includes 8 miles of 10-in., 8-in. and 6-in. cast-iron pipe and laying same, valves and hydrants, pumping station and intake; gravity mechanical filters, power pumping machinery, and concrete reservoir. Plans, specifications, form of proposal and contract may be seen at the office of the water commissioners, Williamson, and obtained at the office of H. C. Kittredge, engineer, German Insurance Building, Rochester, N. Y., for which a deposit of $10 will be required to be refunded upon return of same. Proposals to be addressed to R. M. Cheetham, Williamson.

CHESTER, PA.—The Beacon Lt. Co., of Chester, has been awarded a contract for furnishing electricity to the American Vicose Company's plant at Marcus Hook. Ballinger & Perrot, of Philadelphia, are engineers and architects.

KITTANNING, PA.—For the purpose of furnishing electricity to the new mining operations being installed on the Shawmut Road, the Kittanning El. Lt. Co. is planning to extend its high-tension transmission line along the Pittsburgh & Shawmut railroad from Kittanning to West Mahoning, thence up Mahoning Creek to Timblin, in Jefferson County.

MEADVILLE, PA.—Plans have been prepared by the Erie R. R. Co., for the construction of a large power plant in connection with its shops in Meadville, to cost about $200,000. The plans provide for the installation of 1600 hp, with arrangements to increase it to 3200 hp when necessary. It is not definitely decided whether the plant will be built or not.

BROADWAY, VA.—We are informed that the proposal to issue $3,000 in bonds to establish a municipal electric-light plant was defeated at an election held recently. Reported in the issue of Jan. 24 to have been carried. C. R. Whitmore is city clerk.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 17, for furnishing at the various navy yards and naval stations supplies as follows: Boston, Mass., Schedule 6321—one electrically heated oil-tempering bath; Schedule 6322—103 fire-control telephones. Brooklyn, N. Y., Schedule 6312—five hydraulic turbine tube cleaners, 120 receiver cords for double-head receivers for wireless apparatus, 140,000 ft. silicon bronze aerial wire; Schedule 6314—10,000 sq. ft. compressed sheet cork for insulating; Schedule 6319—seven electrically operated ice-cream freezers. Washington, D. C., Schedule 6318—1250 lb. pure lead wire in 50-lb. coils, 2800 lb. soft-rolled copper sheets. Bids will also be received at the same place until Feb. 24, as follows: Puget Sound, Wash., Schedule 6328—24 single-stroke, 12-in., 125-volt general alarm bells; Schedule 6325—one electrically operated dough-mixing machine, one electrically operated meat and food chopper. F.o.b. works: Schedule 6338—six electrically operated air compressors, complete; Schedule 6339—44 converting turbo-generating sets from 5 kw to 10 kw. Key West, Fla., Schedule 6334—2000 duct ft. four-duct terra-cotta conduits. Newport News, Va., and Brooklyn, N. Y., Schedule 6336—miscellaneous electrical equipments. Washington, D. C., Schedule 6329—one monorail electric traveling hoist (1½ tons lifting capacity). Indian Head, Md., Schedule 6330—installing and putting in working condition one coaling plant. Washington, D. C., Schedule 6337—one hydraulic pressure pump. Applications for proposals should give the schedule desired by number. T. J. Cowie is paymaster-general, U. S. N.

North Central

BATTLE CREEK, MICH.—The contract for lighting fixtures for the new city hall has been awarded to the R. Williamson Co., of Chicago, Ill., for $4,240.

FENTON, MICH.—The Flint El. Co., of Flint, which recently secured a franchise in Fenton to furnish electrical service here, has obtained most of the right-of-way for its transmission line. As soon as the weather permits work will begin on the erection of the line.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Pwr. Co. is extending its transmission lines to Casnovia, Bailey and Grant to furnish electrical service in those places for which franchises were secured last spring.

GRAND RAPIDS, MICH.—Bids will be received by H. N. Morrill, business manager of the board of education, Grand Rapids, Mich., until Feb. 16, for construction of South High School building, including general construction, plumbing, heating, ventilating and wiring, as per plans and specifications on file at the offices of the architects, Robinson & Campau, Houseman Block, Grand Rapids. Henry E. Crow is president of board.

LANSING, MICH.—A petition has been filed with the City Council asking that the ornamental street-lighting system on East Michigan Avenue be extended.

LISMORE, MICH.—Plans, it is reported, have been prepared by Earl D. Jackson, consulting engineer, Capitol Bank Building, St. Paul, for an electric-light plant in Lismore.

MANISTEE, MICH.—The Manistee County El. Co., it is reported, has announced that it will construct a dam on the Manistee River, to be known as the Lower Junction dam, near High Bridge, about 18 miles from Manistee. Work will be started on the dam within three months, and when completed it will develop about 7000 hp.

RAVENNA, MICH.—Local business men are considering the organization of a company, with a capital stock of $25,000, to develop the water-power in Crockery Creek, from which it is estimated that 300 hp can be developed.

READING, MICH.—The board of electric-light commissioners has recently completed the erection of a new boiler room and coal-storage room (38 ft. by 56 ft.) and is installing a 75-kva, 2300-volt, three-phase, 60-cycle Western Electric generator, one generator switchboard panel and one feeder panel, together with Tirrill regulator for above machine. Two 150-hp Bass return tubular boilers have just been installed. Burr K. Goodman is superintendent.

ROGERS CITY, MICH.—The State Railroad Commission has granted the Rogers City El. Lt. & Pwr. Co. authority to issue $10,000 in capital stock.

UNION CITY, MICH.—The electric light and water works commissioners may install a 1000-gal. pump in connection with the water-works system in the spring. It also expects to purchase in the spring some poles, and will probably erect eight more ornamental lamp standards for five-lamp clusters. F. O. Webber is superintendent of the water and light plant.

VASSAR, MICH.—Within the next 12 months the electric light commissioners expect to expend about $600 for lamps and $100 for electrical supplies. W. A. Peck is superintendent.

BATAVIA, OHIO.—The Board of Public Affairs expects to purchase within the next two or three months one small tank pump. Howard Duckwall is superintendent.

BOWLING GREEN, OHIO.—The Lake Erie, Bowling Green & Napoleon Ry. Co., of Bowling Green, expects to purchase 100 poles, 10 transformers, 36 meters and 250 incandescent lamps. C. G. Taylor is receiver.

CANAL DOVER, OHIO.—The Board of Public Service will purchase in the near future some poles and transformers for the municipal electric-light plant. Osmond Galmond is director of public service.

CHILLICOTHE, OHIO.—The Chillicothe El. R. R., Lt. & Pwr. Co. has purchased a 250-hp Erie City water-tube boiler for delivery April 1. F. K. Sexauer is assistant manager.

CINCINNATI, OHIO.—Bids will be received by the Board of Hospital Commissioners of the city of Cincinnati until Feb. 17 for furnishing labor and material for the erection of the special contagious building for the new General Hospital of the city of Cincinnati, including electric wiring, lighting fixtures, vacuum-cleaning system, dumb-waiter, sterlizing equipment, telephones, clock and elevator. Drawings and specifications are on file at the office of the board of hospital commissioners, Burnet Avenue, Cincinnati, and at the office of Samuel Hannaford & Sons, architects, Hulbert Block, Cincinnati. Frederick S. Spiegel is president.

CLEVELAND, OHIO.—Bids will be received by A. R. Callow, commissioner of purchases and supplies, 511 City Hall, Cleveland, until Feb. 3, for furnishing approximately 88,000 ft. of cable for the Fire Department. Specifications may be obtained at the office of the commissioner. Alfred A. Benesch is director of public safety.

CLYDE, OHIO.—Within the next few months the Board of Public Affairs expects to purchase one motor-driven deep-well pump of 300 gal. capacity. H. B. Dirlam is clerk of board.

COLUMBUS, OHIO.—The name of the Columbus Ry. & Lt. Co. has been changed to the Columbus Ry., Pwr. & Lt. Co. Harold W. Clapp is general superintendent.

GIBSONBURG, OHIO.—The city officials have entered into a contract with the Gibsonburg El. Lt. & Tel. Co. to light the streets of the city for a period of ten years. Work will begin as soon as possible on the installation of the new street-lighting system. It is understood that a day service will be established.

LYNCHBURG, OHIO.—Within the next 12 months the Board of Public Affairs expects to erect a new pole transmission line and to purchase one boiler, an exciter, one panelboard, 10 new transformers and 20 meters for lighting service and 400 incan-

descent lamps. C. W. Morrow is superintendent of the municipal electric-light plant.

MANCHESTER, OHIO.—The Board of Public Affairs expects to purchase within the next 30 days material for wiring a moving-picture theater building (26 ft. by 90 ft.), using rigid iron conduit; also within the next three months to purchase 25 6.6-amp tungsten lamps (2200 volts) and street hoods complete; also within the next six months to purchase 15 5-amp, single-phase wattmeters, about 300 lb. No. 6 and No. 8 triple-braided wire and 100 lb. No. 10 double-braided iron wire. B. P. Stone is manager.

MAUMEE, OHIO.—The Valley Lt. & Pwr. Co., of Maumee, expects to purchase within the next two months 15 6600-volt transformers (from 2 kva to 15 kva), three 75-kva transformers (all 6600/220/110 volts), insulators for 12 miles of pole line, lightning arresters and blocks. H. E. Lovett is local manager.

MONROEVILLE, OHIO.—The Board of Trustees of Public Affairs is contemplating changing the system of the municipal electric-light plant from 133 cycles to 60 cycles in the near future. E. M. Alberts is secretary of board.

NELSONVILLE, OHIO.—The Hocking Pwr. Co., of Nelsonville, it is reported, has secured a site for its proposed new power house and has purchased equipment for a 5000-kw plant; it also has bought 1000 acres of coal lands from which it will secure fuel. Work, it is understood, will begin on the plant within the next two months.

PAULDING, OHIO.—Within the last six months improvements have been made to the municipal electric-light plant and water-works system involving an expenditure of $30,000, and including the installation of a 150-hp boiler, two 80-kva Ridgway engines and generators (changing the system from direct to alternating current), rebuilding the city distribution system, and installing 100 series incandescent street lamps, an auxiliary motor-driven deep well and central-station pump, and erection of a 76,000-gal. steel water tank. A day service has also been established. L. O. Farnsworth is superintendent.

ROCKFORD, OHIO.—Within the next six months the Rockford El. Ltg. Co. expects to erect a transmission line from Rockford to Mendon, a distance of 10 miles; also to purchase within the next six months a regulator for switchboard and lightning arresters for 12 miles of rural line. S. J. Robinson is secretary.

SALINEVILLE, OHIO.—The Salineville El. Lt., Ht. & Pwr. Co. expects to purchase within the next eight months one 150-kw to 180-kw, single-phase, 60-cycle, 1100-2200-volt generator (second-hand). Material for lighting system not yet decided upon. P. S. Hart is superintendent.

UHRICHSVILLE, OHIO.—Plans are almost completed for the merger of the Twin City Trac. Co., of Dennison; the Midland Pwr. & Trac. Co., of Cambridge; the Coshocton Lt. & Ht. Co., of Coshocton, and the Lafayette Lt. & Pwr. Co. with the Ohio Service Co., which will result in the immediate improvement of the light and power service in Uhrichsville and in Dennison. The Ohio Service Co. will begin work in the spring on the erection of a transmission line from Coshocton to Uhrichsville and Dennison, so that electricity may be obtained from the plant in Uhrichsville as well as from the power station in New Philadelphia.

ZANESVILLE, OHIO—Plans which will probably be presented to the City Council are being considered by the Civic Improvement Association for the installation of a municipal electric light plant. The plans provide for the purchase of the Hook Brothers and Aston mill with water-power rights, the property to be used as a site for a municipal power station.

CENTRAL CITY, KY.—The establishment of a large power plant to be operated in connection with a traction line at Central City is reported to be under consideration. Dr. W. H. Netherland, of Louisville, is interested in the project.

PEMBROKE, KY.—The R. H. Power Co., successor to the Pembroke Lt., Pwr. & Wtr. Co., of Pembroke, has recently completed the erection of a 19,000-volt transmission line from Hopkinsville, a distance of 10 miles. Within the next 12 months the company expects to purchase material for the erection of 27 miles of transmission line, including transformers, poles, transmission towers, lightning arresters, insulators, underground conduit, distribution cable and wire, meters, tub transformers, rectifiers, arc lamps, incandescent lamps, lamp-posts, etc. S. G. Ragsdale is general manager.

WINCHESTER, KY.—The installation of an ornamental street-lighting system in a subdivision of the city, recently opened, is contemplated by Victor Bloomfield, N. R. Ratcliff and others.

ANGOLA, IND.—The Indiana Utilities Co., of Angola, has recently completed the erection of 20 miles of transmission lines, connecting Pleasant Lake, Hudson and Waterloo, Ind. R. E. Nihan is superintendent.

LOOGOOTEE, IND.—Within the next six months the Loogootee El. Lt., Pwr. & Wtr. Co. expects to purchase an engine. George E. King is secretary.

MADISON, IND.—The Madison Lt. & Ry. Co. has applied to the Public Service Commission for permission to issue $25,000 in bonds, the proceeds to be used for additions to its power plant and extension of the lighting service to Hanover.

TROY, IND.—The Town Board is reported to have granted DeHaven & McIntyre, of Hardinsburg, Ky., a franchise to install an electric-light plant in Troy.

ALEDO, ILL.—The Tri-County Lt. & Pwr. Co., of Aledo, operates electric-generating stations in Keithsburg, Aledo, Alexis and Woodhull, all in Illinois, and supplies electrical service in Aledo, Alexis, Alpha, Woodhull, Rio, New Windsor, New Boston, Joy and Keithsburg, and is now erecting transmission lines to Viola, North Henderson and Heaton, which places will be connected up soon. The company has a contract with the Edwards River Pwr. Co., whose plant is 1 mile south of Matherville, for energy to operate its entire system, starting out with a maximum of 2000 kw, stepping up from 2300 volts to 33,000 volts, which will be its main distribution at 60 cycles. This will soon be available, when all the other generating stations will be closed down as soon as the various towns are connected up. Construction has been completed from the Keithsburg power station through New Boston, Joy, Aledo and Gilchrist to the Edwards River power station. A new transmission line has already been erected from Alpha to Woodhull, and an old line from Alpha to Rio and New Windsor will be rebuilt. A. M. Barron is general superintendent.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, Room 700-900 South Michigan Avenue, Chicago, until Feb. 5 for furnishing electrical apparatus and supplies, including coils, steel poles, insulators, underground conduit, cable, weather-proof wire, etc. For details see proposal pages. Thomas A. Smith is president of board of trustees.

CHICAGO, ILL.—Bids will be received by the city of Chicago, Room 406, City Hall, until Feb. 2, for furnishing at its water-works shops, 2304 South Ashland Avenue, Chicago, 8 tons of ingot copper and 7 tons of old copper trolley wire, according to specifications on file in the office of the Department of Public Works, Room 406, City Hall. L. E. McCann is commissioner of public works.

BAUDETTE, MINN.—Bids will be received by the Village Council of Baudette until Feb. 2 for furnishing and installing equipment at the municipal water and light plant as follows: One boiler, one engine and generator (directly connected) with belted exciter, switchboard panel, boiler-feed pump, steel smokestack with brick stack base and horizontal smoke connection to connect new boiler in plant, with all proper connections and accessories. Franz W. Schmidt is acting clerk.

CROOKSTON, MINN.—The Electrical Devel. Co. has completed a new hydroelectric development, consisting of a 14-ft. dam (which can be raised to 20 ft. by flashboards) and power house for three units. Only one unit has been installed, consisting of a 500-kva Westinghouse three-phase, 60-cycle, 2300-volt generator and accessories, and one 750-hp Morgan-Smith high-speed waterwheel, operating under a 16-ft. head.

FARIBAULT, MINN.—Bids will be received at the office of the State Board of Control, State Capitol Building, St. Paul, until Feb. 9, for alterations and additions to the north wing of the School for the Blind, Faribault; also for alterations and additions to the south wing at the School for Blind at Faribault, including general contract work, heating and ventilating, plumbing and electrical work; also for the erection and completion of the Grand View Cottage at the School for Feeble-Minded at Faribault, including general contract work, heating and ventilating, plumbing and electrical work. Plans and specifications for the above work may be obtained from C. H. Johnston, architect, 715 Capital Bank Building, St. Paul, Minn. Copies of plans and specifications may be seen at the Builders' Exchange in St. Paul and Minneapolis. Bids will be received collectively or separately on each division.

GEORGETOWN, MINN.—The Farmers' Elevator Co., it is reported, is contemplating the installation of an electric-light plant for the purpose of furnishing the towns in this vicinity with electrical service.

GLYNDON, MINN.—The Glyndon Lt. & Pwr. Co., recently incorporated, is installing an electric plant to supply electricity for lamps and motors in Glyndon. The equipment will include one 20-hp oil engine, one 15-kw generator, one booster generator, one four-panel automatic switchboard with automatic service for regulator, one 63-cell, 120-amp-hr. storage battery complete. Machinery has already been purchased. Mr. Geigler, of the Globe El. Co., of Milwaukee, Wis., is engineer in charge of the work. Walter Shave is interested in the company.

LE SUEUR, MINN.—The town of Le Sueur may possibly purchase a 75-kva generator for the municipal electric-light plant during the coming summer. George Sunderman is superintendent.

LITTLE FALLS, MINN.—Preparations are being made by the Little Falls Wtr. Pwr. Co. of Minnesota for the construction of a new concrete dam next summer, to cost from $60,000 to $70,000. The company also proposes to erect a new power house in 1915. John L. McCague, of Omaha, Neb., is president of the company.

MINNEAPOLIS, MINN.—Bids will be received by George H. Hayes, comptroller University of Minnesota, Minneapolis, until Feb. 12, for the erection of service building, Elliott Hospital, at the University of Minnesota, Minneapolis, including the general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul, Minn. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the Builders' Exchange in St. Paul and Minneapolis and at the office of the comptroller.

ALLISON, IA.—Plans are under way for submitting the question of bonding the town for the installation of a municipal electric-light plant to the voters.

CRESTON, IA.—The Creston Mutual El. Lt., Ht. & Pwr. Co. has erected transmission lines to Afton, a distance of 10 miles, and has also installed one 750-hp cross-compound Corliss valve Ball engine, one 250-hp Heine boiler, one 400-kw General Electric generator and one 40-hp, 2200-volt motor-driven exciter. George E. Cornelius is manager.

DENISON, IA.—At an election held recently the proposal to issue $65,000 in bonds for the purchase of the local electric-light plant and for extensions and improvements to same was carried.

INDEPENDENCE, IA.—The city of Independence has recently purchased two horizontal tubular boilers (150 hp, 72 in. by 18 ft., 150-lb. pressure) from the Murray Iron Works, Burlington, Ia., for the municipal electric-light plant. George D. Warren is superintendent.

MARSHALLTOWN, IA.—The city of Marshalltown expects to purchase electrolier posts (not yet decided when) for the municipal street-lighting system. Door L. Lamb is superintendent of parks and public property.

MASON CITY, IA.—The installation of a municipal electric-light plant in Mason City is reported to be under consideration.

GALT, MO.—A 20-year franchise has been granted to Jacob H. Nulf and Norman D. Jordan, of the Union Lt. & Pwr. Co., of Kansas City, to install and operate an electric-light plant in Galt, together with a street-lighting contract. Work will begin immediately on the installation of the system.

LAREDO, MO.—The City Council has granted Jacob H. Nulf and Norman D. Jordan, of the Union Lt. & Pwr. Co., of Kansas City, a 20-year franchise to construct and operate an electric-light plant in Laredo, subject to the approval of the voters.

SIBLEY, MO.—Bonds to the amount of $18,000, it is reported, have been voted for the installation of a municipal electric-light and power plant.

TARKIO, MO.—The Tarkio El. & Wtr. Co. expects to erect a transmission line and to purchase poles, wires and insulators for same. W. F. Marshall is manager.

WARRENTON, MO.—Within the next three months a new street-lighting system (consisting of about 40 tungsten lamps) will be installed in connection with the A. F. Sievert electric-light plant; some line material and several transformers will be purchased within the next three months.

COGSWELL, N. D.—Within the next 12 months the Cogswell El. Lt. & Pwr. Co.

expects to purchase a 10-hp to 15-hp gas engine and a 7½-kw to 10-kw generator. H. L. Saylor is secretary.

FORDVILLE, N. D.—The village of Fordville is reported to be contemplating the installation of a combined electric-light plant and fire protection system and would like to correspond with firms and parties interested. For further information address the secretary of the Commercial Club of Fordville.

LARIMORE, N. D.—Within the next three months the town of Larimore expects to purchase one 30-hp Muncie oil engine; also within the next six months 36 lamp-posts and fittings for street-lighting. N. J. Powell is auditor and manager.

LIDGERWOOD, N. D.—The Lidgerwood Mill Co. expects to purchase within the next 12 months a 60-kva generator and an 80-hp to 100-hp steam engine (directly connected), an automatic voltage regulator and meters as needed. W. R. Movius is president.

SHELDON, N. D.—The Village Board is contemplating the installation of a street-lighting system.

VALLEY CITY, N. D.—The electric light commissioners expect to purchase within the next six months two 250-hp boilers, 175-lb. pressure, with superheaters for 150 deg.; one tub-transformer and 25 series arc lamps. O. N. Bergman is superintendent.

WYNDMERE, N. D.—We are informed that an electric-light plant will be established in Wyndmere in the spring, but it has not yet been definitely decided whether it will be a municipally owned or a private plant. If a municipal plant is decided upon, it will be submitted to the voters on March 18. As yet an engineer has not been engaged.

AURORA, NEB.—Within the next two months the Aurora El. Co. expects to erect a new building, remodeling walls, roofs, etc., adding new front additions (58 ft. by 25 ft.) for offices, workshop, meter room and supply room, for which contract has been awarded to the Middle West Construction Co., of Lincoln, Neb. The company also expects to purchase some electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. Earl A. McCreery is secretary and manager.

BLAIR, NEB.—The Blair El. Lt. & Pwr. Co. has recently purchased a 14-in. by 36-in. Corliss engine and a 120-kw Westinghouse generator with switchboard. E. V. Capps is local manager.

ELWOOD, NEB.—The electric light and water-works commission expects to purchase a 60-hp engine and a 35-kw direct-current generator. It is not yet decided when the contracts will be placed. O. E. Coate is superintendent of the electric-light department.

HEBRON, NEB.—It is expected that an ornamental street-lighting system (consisting of about 30 posts) will be installed some time between now and May 1, 1914. O. P. Hess is superintendent of the municipal electric-light plant.

SPENCER, NEB.—Within the next five months Wood Brothers, owners of the local electric-light plant, expect to erect a new building.

EUREKA, KAN.—At an election held Jan. 20 the proposal to establish a municipal electric-light plant was defeated. R. M. Wilson, proprietor of the local electric-light plant, whose franchise has expired, will ask for a new franchise in the near future.

STOCKTON, KAN.—The city of Stockton has recently awarded a contract to the Merkle-Hines Machinery Co., of Kansas City, Mo., for an 8-in. by 19-in. Smith-Vaile triplex pump directly connected to a 30-hp General Electric 2200-volt, three-phase motor. O. M. Goodrich is superintendent.

WICHITA, KAN.—The Kansas City Gas & El. Co., of Wichita, expects to purchase within the next 12 months 1200 kva in transformers (from 5 kva to 50 kva), 300 poles (30 ft. to 60 ft.), 4000 insulators (2300 volts), 75,000 lb. weather-proof insulated copper wire (sizes 0000 to No. 10), 300 alternating-current, 110-volt, two-wire and three-wire, 5-amp to 10-amp meters; also 800 series tungsten lamps (80-watt and 100-watt) and 50 series magnetic arc lamps; 1000 electric irons and 700 miscellaneous devices. J. H. La Grant is purchasing agent and Theodore Slade is assistant to manager.

Southern States

HENDERSONVILLE, N. C.—The Hendersonville Lt. & Pwr. Co. expects to erect a power house (No. 2) on the Big Hungry River within the next three months. The work will be done by the company under the charge of W. H. Bangs, engineer and superintendent. Within the next three months the company also expects to purchase a 150-kw to 175-kw, three-phase, 60-cycle, 2300-volt generator (900 r.p.m.) and waterwheels to drive same. R. M. Oates is president.

HIGH POINT, N. C.—Within the next six months the electric light commission expects to erect about 1 mile of distribution line in the suburbs. A distribution line about 2 miles long has been erected to the rural districts at the expense of the customers along the lines. H. C. Bulla is manager.

KINGS MOUNTAIN, N. C.—The managers of the municipal electric-light plant would like to receive catalogs and prices on vacuum cleaners. G. T. King is superintendent of the municipal electric-light plant.

MOORESVILLE, N. C.—The town of Mooresville will erect immediately a substation and 1 mile of three-phase transmission line for power load. It will also purchase within the next few months an ornamental street-lighting system for the business section. James L. Donald is superintendent.

NORTH WILKESBORO, N. C.—The town commissioners are contemplating the installation of an engine and boiler as auxiliary to water-power for the municipal electric plant.

ROANOKE RAPIDS, N. C. — The Roanoke Rapids Pwr. Co., it is reported, contemplates the installation of an electric plant. The company already has a franchise to operate in Roanoke Rapids.

TROUTMANS, N. C.—The installation of an electric-light plant is reported to be under consideration by the town officials.

WENDELL, N. C.—Bonds to the amount of $15,000 have been voted for the installation of a municipal electric-light plant. It is reported that a site, including dam and building on the Little River, has been purchased. Electricity will be transmitted 4 miles. The contract for installing the plant is said to have been awarded to the J. W. Smith El. Co., of Norfolk, Va.

WILMINGTON, N. C.—Within the next three months the Tidewater Pwr. Co., of Wilmington, expects to purchase one 500-kw rotary converter with switchboard for same; also within the next few months to purchase a complete street-lighting system (type undecided) and the usual amount of electrical appliances and supplies. Raymond Hunt is superintendent of electrical department.

LAKE CITY, S. C.—Bids will be received by the Board of Public Works, Lake City, S. C., until Feb. 10, for the installation of an electric-light plant, in accordance with plans and specifications on file in the office of the board; also for prices on engine, boiler, generator and electrical equipments for a 100-hp plant.

WEST UNION, S. C.—The construction of a hydroelectric plant at Rhett Shoals on Big Cane Creek, 2 miles below West Union, is reported to be under consideration by W. A. Strothers and J. W. Bell, of Walhalla. Electricity generated at the plant will be transmitted to West Union and Walhalla.

VALDOSTA, GA.—We are informed that G. I. Tilman, civil engineer, of Whigham, will have charge of the construction of the proposed power plant on the Willachoochee River. A. B. Langford, of Valdosta, reported in the issue of Jan. 10 to be making preliminary surveys for the proposed plant, is interested in the project.

JACKSON, TENN.—The citizens on Jan. 19 voted in favor of issuing $25,000 in bonds for extensions and improvements to the municipal electric-light plant. J. L. Williamson, of Jackson, is engineer in charge.

NASHVILLE, TENN.—The Nashville Trac. Co., which proposes to build a new street railway line in Nashville, will begin operation as soon as the city commissioners approve the application of the company for certain rights-of-way. The company has contemplated building a power plant in the Green River coal fields, 85 miles from this city, but now that the city has obtained a reduction in coal rates, this plan may be abandoned and a power plant erected in the city. One of the propositions reported to be under consideration is securing the municipal light and power plant in the event that the city contracts with the Tennessee Pwr. Co. for hydroelectric power, which has been discussed.

RICHTON, MISS.—The installation of an electric-light plant in Richton is under consideration. John MacDonald and others are reported to be interested in the project.

CAMDEN, ARK.—The Arkansas Pwr. Co., recently incorporated, has purchased the plants of the Camden Pwr. Co., of Camden; the Malvern El. Co., of Malvern; the Arkadelphia El. Lt. Co., and the Wilson Wtr. & El. Co., both of Arkadelphia, and the Standard Ice & Lt. Co., of Magnolia; J. H. Meek, of Fordyce, is president of the company, J. W. Lee, of Malvern, treasurer, and J. L. Longino, of Little Rock, secretary.

HOT SPRINGS, ARK.—The Citizens' El. Co., of Hot Springs, controlled by the Federal Lt. & Trac. Co., of New York, N. Y., has erected a new turbine station with an output of 2825 kva and has purchased four 316-hp Heine boilers, one 1250-kva General Electric turbine, two 300-kw General Electric motor-generator sets for railway service and one 20-panel switchboard. It has also erected 2 miles of trunk line from new power house to distributing points. W. A. Haller, 60 Broadway, New York, N. Y., is general superintendent of the Federal Lt. & Trac. Co.

RUDDELLS, ARK.—The Arkansas Lime Co., it is reported, expects to purchase a 180-kw, 220-volt direct-current generator, with switchboard complete and 12 motors from 10 hp to 40 hp each.

NATCHITOCHES, LA.—The city of Natchitoches expects to purchase within the next four months one 10-hp pumping plant for the Normal School; also within the next six months one 50-kw generating unit, consisting of generator and engine (three-phase, 60 cycles, 2300 volts) and switchboard, material for 1 mile of line (primary and secondary) for residential lighting. W. E. Aymond is superintendent.

VINTON, LA.—Bids will be received by the parish school board of Vinton, La., for the erection of a two-story (17-room) brick school building until Feb. 10. Plans and specifications may be obtained from A. H. Humphrey, architect, of St. Charles, upon deposit of $5, which will be refunded upon return of same. Heating, plumbing and electric wiring will be in separate contracts. F. M. Hamilton is secretary and treasurer of board.

WINTHROP, LA.—It is understood that an electric-light plant will soon be installed in Winthrop, for which a franchise has been granted.

BOWIE, TEX.—The Bowie Lt. & Pwr. Co., recently incorporated, has taken over the electric plant of the Bowie El. Lt. & Pwr. Co., which it will operate until the new plant is completed. Plans have not yet been completed for new equipment. W. C. Woodlief, P. O. Box 1615, Dallas, Tex., is engineer in charge of the work. The general office of the company is at 1006 Commonwealth Building, Dallas, Tex.

CAMERON, TEX.—The Cameron Wtr., Pwr. & Lt. Co. is contemplating enlarging its plant during the coming year. The company is considering adding to its equipment a 250-kw engine-driven generator, but no definite conclusion has been reached. The Scott Consulting Engineering Co., of Dallas, Tex., has charge of the engineering work for this company. C. W. Lawrence is secretary and manager.

DALLAS, TEX. — Extensive improvements are contemplated by the Dallas Consol. El. Ry. Co., involving an expenditure of $6,000,000, to include double-track viaduct across Trinity River bottom to Oak Cliff, additional equipment for power station, improvements and extensions to carshops and carhouses, interurban terminal building, completion of underground electric wiring, etc. The Stone & Webster Engineering Corpn., of Boston, Mass., has charge of the work.

EL PASO, TEX.—The El Paso El. Ry. Co., it is reported, contemplates the installation of a 4000-kw turbo-generator with condenser and switchboards, 2600-hp Babcock & Wilcox boilers, 1000-kw motor-generator set for railway service and additional cooling tower. The Stone & Webster Engineering Corpn, of Boston, Mass., has charge of the work. H. S. Potter is general superintendent.

PECOS, TEX.—The City Council is contemplating the installation of an ornamental street-lighting system in the business district.

SAN ANGELO, TEX.—J. D. Sugg, owner of the local street railway system, is contemplating extensions to the system and the erection of a new power plant.

Pacific States

MOUNT VERNON, WASH.—Preliminary plans have been prepared by the Pacific Northwest Trac. Co., of Mount Vernon, for extending its transmission lines from here to La Conner. Electricity will be supplied to farmers along the line. The Pacific company, it is reported, will purchase the power plant of the La Conner Pwr. Co.

TACOMA, WASH.—The Pacific Iron & Steel Co., of Tacoma, has recently signed a five-year lease with the city of Tacoma for a tract of tideland on the Middle Waterway, where it will build an electric blast smelter, at a cost of about $50,000. Five furnaces will be installed. The first unit will be in operation by April 15, and other units will be installed at once. George Lewis Casey, of Seattle, is president.

TACOMA, WASH.—Bids will be received by Nicholas Lawson, commissioner of light (closing date not yet announced), for furnishing material for the proposed cluster-lamp system, to cost $36,000, as follows: 31,500 ft. of No. 8 5000-volt, steel-taped cable; 2500 ft. No. 10 duplex 5000-volt cable; 252 6.6-amp inverted luminous arc lamps, 246 metal posts, 255 series cut-outs, 15,000-volt insulation; five 6.6-amp, series-arc mercury rectifier sets, without switchboard panel. Bidders may submit bids on any or all units.

EUGENE, ORE.—Plans for the installation of electrical equipment at the Springfield mill of the Booth-Kelly Lumber Co. provide for about 2500 hp in motors ranging from 5 hp to 300 hp. Motors over 50 hp will be 2200-volt, three-phase, and under 50 hp will be 440-volt, three-phase. General Electric equipment will be used throughout. Electricity for operating the plant will be furnished by the Oregon Pwr. Co. from its Springfield plant. A switchboard will be installed in the machine room. All transformers will be of oil-cooled General Electric type and will be installed in concrete vaults. It is expected to have the plant in operation by July 1, 1914. The installation was designed by R. G. Sittler, of the West Coast Engineering Co., of Portland, Ore.

CHICO, CAL.—Plans are being considered for the installation of a new street-lighting system in Chico.

COACHELLA, CAL.—Application has been made to the State Railroad Commission by the Electric Ser. Co. for authority to issue $75,000 in capital stock for the erection of an electric plant in the Coachella Valley. James H. Northrup, Roger G. Lewis and Nolan B. Stadley are interested in the company.

SAN BERNARDINO, CAL.—The Southern Sierras Pwr. Co. is preparing plans to enlarge its plant at Barstow and to extend its distribution system to cover the entire city of San Bernardino. The company plans to furnish many of the ranchers in the Mojave Valley with electricity for lamps and motors. W. W. Brison is district manager.

SAN LUIS OBISPO, CAL.—Plans have been submitted to the City Council for lighting the business section of the city with electroliers. The estimates provide for the installation of 101 standards, carrying three lamps each (two 60-watt lamps and one 100-watt lamp), to cost about $12,000.

SAN RAFAEL, CAL.—The Council has passed a resolution authorizing the erection of 97 electroliers along Fourth Street from East Street to Tamalpias Avenue and on B Street from Second to Sixth Street. The cost of the system is estimated at about $10,000.

WOODLAND, CAL.—The State Water Commission has granted the Yolo Wtr. & Pwr. Co. permission to appropriate 500 second-ft. of water from Cache Creek, the outlet of Clear Lake. The company proposes to irrigate 150,000 acres of land in Yolo County, near Woodland. It is estimated that 50,000 hp can be developed under the permit granted the company.

KELLOGG, IDAHO.—Within the next six months the Long Valley Lt. & Pwr. Co., of Kellogg, expects to erect about 10 miles of 6600-volt transmission line; also to purchase one 300-kva generator, a 500-hp waterwheel and four 25-kva transformers. Walter C. Clark is president.

NEW MEADOWS, IDAHO.—The Adams County Lt. & Pwr. Co., of New Meadows, has secured a site on the Little Salmon River for its proposed hydroelectric power plant. The proposed plant will be equipped with 370-hp waterwheels, 250-kw generator, switchboard, etc., and three 150-kw transformers for generating station. Substations in Meadows and New Meadows will be equipped with three 50-kw transformers; Council and Cambridge, three transformers, 50 kw each; Midvale, three, 75 kw each; McCall, three, 25 kw each, and Tamarack, three 75-kw transformers; 2600 cedar poles will be used for 81 miles of three-phase overhead lines; the number of lamps and meters not decided upon. The company will do all its wiring and will carry wiring supplies for inside work to the amount of $5,000. Electricity is furnished by the company in Cambridge with a temporary hydraulic installation. The company will do all its own work. No contracts have yet been placed for equipment of hydroelectric plant. W. H. Hill, of Grangeville, is engineer in charge. B. Gustad is president and general manager.

DEER LODGE, MONT. — The Deer Lodge El. Co. expects to purchase a carload of poles, three or four transformers, wire, meters, etc. H. H. Zenor is secretary and treasurer.

GLENDIVE, MONT.—Within the next six months the Glendive Ht., Lt. & Pwr. Co. expects to build a new plant, equipped with one 500-kw steam turbine, one 300-kw steam turbine, with boilers, switchboard, smokestack, coal conveyor, etc. Frank C. Hughes is manager.

LAMAR, COL.—The Intermountain Ry., Lt. & Pwr. Co., it is reported, will apply to the City Council for a franchise to install and operate an electric-light and heating plant in Lamar.

TRINIDAD, COL.—A movement has been started by the Chamber of Commerce for the installation of an ornamental street-lighting system, which includes the erection of a large electric arch at the gateway of the city. A. L. Branson, Eli Jeffreys and V. M. Friar are interested.

ELKO, NEV.—Within the next 12 months the Elko-Damoille Pwr. Co., of Elko, expects to purchase electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. The company purchased on Dec. 1, 1913, the gas-engine-driven plant of the Elko Wtr. & Lt. Corpn. B. G. McBride is manager.

ALAMOGORDO, N. M. — Within the next three months the Alamogordo El. Lt. & Pwr. Co. expects to purchase one 120-hp engine (Diesel type) and an 80-kw generator.

LAS CRUCES, N. M.—Within the next six months the Las Cruces El. Lt. & Ice Co. expects to purchase one or more boilers (probably 200 hp each). D. W. Morgan is manager.

PORTALES, N. M.—Within the next six months the city of Portales expects to purchase 54 poles and eight or ten 5-hp motors. W. E. Keeter is manager.

TUCUMCARI, N. M.—Within the next two months the Tucumcari Lt. & Pwr. Co. expects to purchase 27,000 ft. No. 6 weatherproof wire and 50 30-ft. poles, one 5-kw regulating transformer and 30 ornamental brackets for series tungsten lamps. S. B. Richey is resident manager.

Canada

LETHBRIDGE, ALTA.—Tenders will be received until Feb. 9 for the installation of an electric passenger elevator, including motor, generator, etc., for a public building at Lethbridge. Plans and specifications may be obtained from the Department of Public Works, Ottawa, Ont. R. C. Desrochers is secretary.

VICTORIA, B. C.—The Stamp Falls Pwr. Co. has been organized to take over the Ritchie Agnew Pwr. Co. and the British Columbia Hydraulic Pwr. Co. on Vancouver Island. It is understood that the new company will install new equipment and make extensive additions to the plants.

WINNIPEG, MAN.—Tenders will be received by the Board of Control, Winnipeg, until Feb. 20, for furnishing overhead construction and line materials required by the city Light and Power Department during the year 1914. Plans and specifications may be obtained from the office of the Light and Power Department, 54 King Street, Winnipeg. M. Peterson is secretary of the board of control.

BERLIN, ONT.—The City Council is contemplating asking the Hydro-Electric Commission of Ontario to prepare a report of the probable cost and feasibility of erecting a transmission line from Berlin to Woodstock, via New Dundee, Plattsville and Tavistock; it is also proposed to discuss the question of extending the township lines in Waterloo County.

LONDON, ONT.—The London El. Co. is contemplating making additions to its power house and equipment, to cost about $125,000. C. T. Barnes is manager.

MOOSE JAW, SASK.—It is reported that provision is being made by the government for the installation of a power house to furnish power for the new elevators at Moose Jaw. It is understood that a gas-producer plant will be installed. This will increase the cost of the elevator plant from the original estimate of $1,200,000 to $1,500,000.

SASKATOON, SASK.—New equipment is being installed at the municipal power plant, including a 3200-kw turbo-generator and condensing equipment, supplied by the Canadian Westinghouse Co.; also two centrifugal pumps with a rating of 86 hp and 110 hp respectively, with a combined capacity of 7200 imperial gallons. T. G. McIntosh is secretary.

Mexico

MEXICO CITY, MEX.—Application has been made to the federal government by Antonio Villa Ahiji and Faustino E. Moranda for a concession for the use of the waters of the Rio Blanco and the Los Xuxchites waterfall, in the State of Vera Cruz, the power to be used to generate electricity.

Miscellaneous

PANAMA.—Bids will be received by the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Feb. 6, for electrical cable, conduits and fittings and miscellaneous electrical apparatus, steel shapes and plates, steel reinforcing bars, valves, etc. Blanks and general information relating to this circular (No. 824) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

AUCKLAND, N. Z.—Tenders will be received by S. Irwin Crookes, consulting engineer, 14 Palmerston Buildings, Auckland, N. Z., until March 26, for equipment of hydroelectric power plant of the Dominion Portland Cement Co., New Zealand, at Wairua Falls as follows: Section 1—hydraulic equipment, including turbines with a rating of 1500 hp each, governors, valves, etc.; section 2—generators with a rating of 1000 kw each, exciters, automatic regulators, etc. Specifications and drawings may be obtained at the office of A. S. Lascelles & Co., Maritime Buildings, 8-10 Bridge Street, New York, N. Y. For details see proposal pages.

New Incorporations

WILMINGTON, DEL.—The Huntsville Consol. Gas Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 for the purpose of generating and selling electricity and gas for lamps, heaters and motors. The incorporators are: F. D. Buck, B. M. Grawl and G. W. Dillman, of Wilmington.

DAWSON SPRINGS, KY.—The Dawson Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by D. B. Kevil, J. S. Kevil and E. A. Stevens.

LOUISVILLE, KY.—The Standard Ltg. & Htg. Co., of Louisville, has been incorporated with a capital stock of $1,000 to establish a plant. T. C. H. Vance, Inter-Southern Building, Louisville, is in charge.

ROCKCASTLE, KY.—The Mount Vernon Pwr. Co. has been incorporated with a capital stock of $5,000 by L. W. Bethurum, E. S. Albright, C. D. Sutton and others.

WAYLAND, N. Y.—The Wayland-Steuben Pwr. Co. has been chartered with a capital stock of $50,000. The incorporators are V. M. Kimmel, J. Kimmel and O. F. Kiefer, of Wayland.

CLEVELAND, OHIO.—The Guttentag Lt. Co. has been incorporated with a capital stock of $5,000 by Harry Guttentag, A. M. Wittenberg, J. B. Wulkom and Sidney Mendelson.

PORTLAND, ORE.—The Garibaldi Pwr. Co. has been incorporated with a capital stock of $15,000 by Charles J. Schnabel, Newton C. Smith and J. B. Ofner.

LUDLOW, PA.—A charter has been granted by the State Department for the Ludlow El. Co. to operate in Hamilton Township, in conjunction with the Ludlow Natural Gas Co. The company is capitalized at $15,000. The incorporators are Homer Shoemaker, George R. Barnett and E. E. Barnitz.

MARION, S. D.—The Marion Lt. & Pwr. Co. has been incorporated with a capital stock of $25,000 by J. A. Hereen, John Groepel, M. H. Dains and S. H. Dains, of Marion.

BANGS, TEX.—Articles of incorporation have been filed for the Bangs Fuel & Lt. Co. with a capital stock of $10,000. The incorporators are James W. Wayman, Charles Hart and R. F. Hart.

MEADOW VIEW, VA.—The Edmonson El. Co. has been incorporated with a capital stock of from $5,000 to $25,000. The officers of the company are: D. H. Edmonson, president, and S. W. Edmonson, secretary, both of Meadow View.

SEATTLE, WASH.—The Pwr. Devel. Co. has been incorporated with a capital stock of $100,000 by W. S. Summers, Frank MacKean, H. S. Volkmar and others.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 20, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,084,595. Booster Regulation; C. Ambruster and H. M. Beck, Chicago, Ill. App. filed March 24, 1906. For compelling or controlling the charge or discharge of a battery.

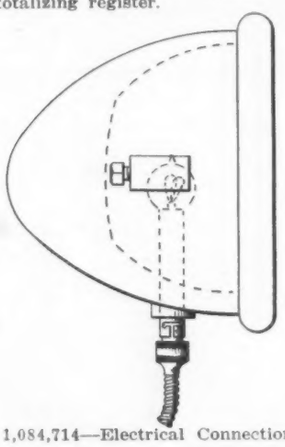
1,084,610. Railway Signaling System; W. J. Cook, Denver, Col., and S. Deutsch, Chicago, Ill. App. filed Aug. 29, 1911. Block system including normally closed circuit with electromagnet and intermittently closed circuit with motor for moving semaphore arm.

1,084,611. Accounting Device; W. J. Crumpton, Superior, Wis. App. filed June 11, 1908. For accounting and indicating at all times the time or wages to be credited to a large number of workmen. (Sixty-seven claims.)

1,084,612. Automatic Accounting System; W. C. Crumpton, Evanston, Ill. App. filed March 6, 1909. Register-actuating arrangement for time or wage accounting. (Fifty-eight claims.)

1,084,613. Accounting System; W. J. Crumpton, Evanston, Ill. App. filed May 26, 1909. Time, wage, job and cost accounting. (Eighty-seven claims.)

1,084,614. Accounting System; W. J. Crumpton, Evanston, Ill. App. filed Sept. 16, 1909. Wage and cost accounting system, including individual as well as totalizing register.



1,084,714—Electrical Connection

1,084,615. Accounting System; W. J. Crumpton, Evanston, Ill. App. filed Oct. 13, 1909. Workmen's wage registers as well as time registers are actuated concurrently as distinguished from intercurrently.

1,084,629. Zirconium Lamp Filament; C. A. Hansen, Schenectady, N. Y. App. filed Feb. 19, 1908. Mixes zirconium oxalate with finely divided carbon, shapes mixture into threads and heats threads to produce refractory filaments.

1,084,634. Two-Way Register-Actuating Mechanism; F. O. Heuser, Chicago, Ill. App. filed April 16, 1909. The register reading is increased or decreased according to the direction in which the armature of an electromagnet is actuated.

1,084,641. Advertising Device; H. J. Keating, Chicago, Ill. App. filed Aug. 6, 1912. Includes a solenoid for lifting the arm of an advertising figure.

1,084,645. Electrical Appliance; J. H. Lehman, New York, N. Y. App. filed Dec. 3, 1912. Circuit-breaker for magneto and distributor used for ignition purposes.

1,084,657. Cover for Telephonic Apparatus; G. H. Nash, Highbury, London, Eng. App. filed Jan. 9, 1911. Cover for electromagnetic relay having movable contact points.

1,084,660. Accounting System; A. F. Poole, Chicago, Ill. App. filed June 11, 1908. Individual wage and time registers are actuated by a step-by-step movement controlled by electromagnetic means.

1,084,661. Accounting System; A. F. Poole, Chicago, Ill. App. filed April 9, 1910. The particular rate at which a certain individual register shall be operated is determined by inserting a connecting plug in any particular jack.

1,084,669. Accounting System; C. H. Tallmadge, Chicago, Ill. App. filed March 1, 1909. Each workman has assigned to him a wage register which automatically indicates the amount of wages he has earned.

1,084,670. Piecework-Accounting System; C. H. Tallmadge, Chicago, Ill. App. filed Dec. 20, 1909. For indicating the wages of a workman who is employed on piecework.

1,084,672. Automatic Time-Accounting Device; A. A. Thomas, Chicago, Ill. App. filed Nov. 18, 1908. Electrically actuated device operates register at end of periodic intervals, the workman being required to close his switch at the beginning of an interval.

1,084,673. Spot-Welding Machine; E. Thomson, Swampscott, Mass. App. filed May 10, 1913. Transformer mounted on a pedestal and the welding electrodes are supported vertically in line with the transformer.

1,084,674. Maintaining a Constant Power-Factor in a System of Distribution; A. A. Tirrill, Schenectady, N. Y. App. filed Aug. 20, 1908. Automatically regulates the field excitation of the synchronous machine in response to changes in the power-factor.

1,084,684. Accounting System; L. A. Williams, Evanston, Ill. App. filed Jan. 26, 1909. Each register has two indicators, one for wages and one for time.

1,084,685. Accounting System; L. A. Williams, Evanston, Ill. App. filed Feb. 11, 1909. A waste-wage register is actuated when the workman is not employed on a specific job and ceases actuation when actuation of the job register begins.

1,084,686. Automatic Time-Accounting Device; L. A. Williams, Evanston, Ill. App. filed Feb. 24, 1911. For automatically taking account of the workman's time or wages.

1,084,698. Controller for Electric Motors; J. H. Hall, Cleveland, Ohio. App. filed Oct. 16, 1912. Motor is first connected to the supply circuit through a transformer and then directly to the supply circuit.

1,084,703. Electric Cut-Out; A. V. A. McHarg, New York, N. Y. App. filed April 30, 1913. Cut-out block for three-wire system.

1,084,706. Fuse Plug; T. E. Murray, New York, N. Y. App. filed June 9, 1913. Fuse plug of the type adapted to enter between pairs of spring contacts.

1,084,714. Electrical Connection; J. C. Stearns, Worcester, Mass. App. filed March 22, 1913. For connecting an armored cable with a lamp or the like.

1,084,720. Electric Meter; G. M. Willis, Chicago, Ill. App. filed Jan. 5, 1910. Has a cover plate protecting the armature and special terminal posts sealed to prevent accessibility.

1,084,721. Shunt for Measuring Instruments; G. M. Willis, Chicago, Ill. App. filed Feb. 17, 1911. Shunt adapted for use with any particular electrical instrument.

1,084,722. System for Electrical Distribution; J. L. Woodbridge, Philadelphia, Pa. App. filed April 19, 1904. Includes a "floating" battery arranged to do more or less regulation of the station load.

1,084,723. Dynamo-Electric Machine; J. L. Woodbridge, Philadelphia, Pa. App. filed April 20, 1909. Constructed to give a constant single-phase current output.

1,084,741. Electrical System of Distribution; R. C. Hull, Philadelphia, Pa. App. filed Oct. 25, 1911. Controls field excitation of variable-speed dynamo to give substantially constant potential.

1,084,745. Electric Primer; C. F. Lindsay, Fairfield, Conn. App. filed Sept. 8, 1913. Constructed so that all pressures exerted in the primer tend to tighten the parts, making it absolutely gas-tight.

1,084,765. Signaling System for Railways; J. D. Taylor, Edgewood Park, Pa. App. filed June 17, 1908. Of the type in which the track rail forms the return path for the propulsion current.

1,084,780. Signaling System; C. E. Beach and H. W. Doughty, Binghamton, N. Y. App. filed April 9, 1912. Provides indicating means so that it can be quickly ascertained which auxiliary station was the one actuated.

1,084,809. Light-Reflecting Device; E. C. McKinnie, Chicago, Ill. App. filed Jan. 30, 1913. Semi-indirect lighting fixture.

1,084,822. Loud-Speaking Attachment for Telephones; H. W. Prance, London, Eng. App. filed June 25, 1913. Trumpet supported in connection with a telephone receiver.

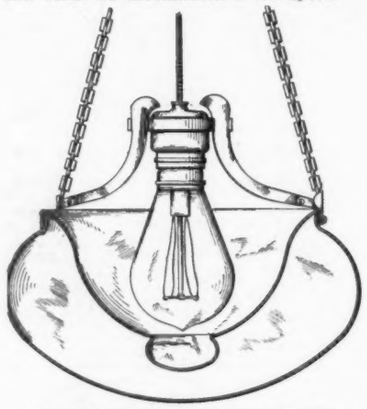
1,084,856. Method of Manufacturing Phosphoric Acid; M. M. Haff, Ottawa, Ontario, Canada. App. filed Sept. 27, 1913. Electrically heats silicious material with phosphatic material.

1,084,877. Electric Heating Table or Counter; E. C. Cary, Baltimore, Md. App. filed Feb. 24, 1913. Table with recesses for the dishes or pans and electric heaters in said recesses.

1,084,907. Tactical Naval Tracer; F. Spalazzi, Rome, Italy. App. filed June 17, 1911. Automatically records the course of the ship and also on the same sheet the course of an enemy's ship.

1,084,910. Method of Localizing Faults in Cables and Circuits; J. H. J. A. Stephenson, Hamburg, Germany. App. filed Nov. 14, 1911. Machine which indicates automatically and without calculation the distance of a fault in the cable.

1,084,924. Magneto-Electric Generator; M. C. Brenot, Issy-les-Moulineaux, France. App. filed March 18, 1912. Special form of mechanical interrupter.



1,084,809—Light-Reflecting Device

1,084,926. Hand-Lamp; C. F. Burgess, Madison, Wis. App. filed Sept. 13, 1913. Has an adjustable focusing lens for focusing or dispersing the light.

1,084,931. Starter and Ignition Control; J. B. Entz, Cleveland, Ohio. App. filed Jan. 18, 1913. Eliminates the possibility of premature ignition when engine is being turned over by the starter.

1,084,932. Testing Device for Jump-Spark Ignition Systems; T. H. Estes, Texarkana, Tex. App. filed Oct. 28, 1912. Insulating handle with a wire bent to form two parallel spaced bridging terminals.

1,084,936. Electric Ground Clamp; R. R. Forbes, Mount Holly, N. J. App. filed Dec. 20, 1911. Adjustable to fit pipes of different sizes.

1,084,991. Furnace for Refining Metals; E. C. Wills, Frederick, Md. App. filed Jan. 30, 1913. Electric furnace mounted to rock for the purpose of air treatment and to eliminate the dross.

1,085,011. Equipment for Locomotives; C. L. Bopp, Waterloo, Ia. App. filed March 14, 1912. Brush attachment for taking current from a third-rail for signaling purposes.

1,085,036. Selective Apparatus; G. H. Groce, Chicago, Ill. App. filed Dec. 7, 1908. Employed where it is necessary to operate apparatus at a plurality of stations selectively and independently.

1,085,069. Telautographic Apparatus; G. S. Tiffany, Summit, N. J. App. filed April 5, 1912. Employs magnets of the consequent-pole type instead of those of the salient-pole type previously used.

1,085,089. Process of Electric Welding; L. S. Lachman, New York, N. Y. App. filed Aug. 12, 1910. Longitudinal and transverse members welded by partially embedding one in the other and subjecting to welding current and pressure.